Softening of Water.

BY BALDWIN LATHAM, M. INST. C. E., F. G. S., F. R. MET. SOC., ETC.

Introduction—From the remotest period of antiquity of which we have any record the art of softening water for the purposes of washing and cleansing appears to have been known and adopted. Long anterior to the invention of soap, of which the elder Pliny gives us the earliest account, as having been first manufactured by the Gauls, caustic alkali, derived from wood ashes and from natural earths, was used as a lye. The process of making an alkaline lye was mentioned by Aristophanes (434 B. C.), and also by Plato (348 B. C.). We have also a record in the volume of Sacred Writ, in Jeremiah ii., verse 22, "For though thou wash thee with nitre and take thee much soap." The Hebrew word "corith" used in this passage is stated by authorities to refer to the vegetable lye or potash, but in another passage of Sacred Writ, Malachi iii., verse 2, where reference is made to "fuller's soap," the Hebrew word "nether" is there believed to apply to a mineral lye or soda. The people of Egypt were known to use mineral alkali and ashes of plants for the purpose of making a lye for washing from an early period, as recorded by Pliny.

Nitrum, a natural lixivious salt, which is found in many southern countries, was well known, and was used for washing at a very early period. Certain plants, too, the sap of which is of a saponaceous nature, were used in early days instead of soap. Meal and many kinds of seeds and bran were also used in connection with washing operations. The urine of various animals, kept till it became stale, and alkaline was used in Eastern countries at a very early period; and in the Avesta special directions are given for cleansing and purifying with the urine of the sacred cow. Pliny, in his "Natural History," states that if water be nitrous or brackish, or bitter, if some fresh barley-meal is put into it, that within two hours it will be so amended and sweet that a man may drink thereof; and a translation made from Pliny, by Dr. Philemon Holland, in 1634, goes on to recount that the same operation of sweetening water may be effected by a kind of chalk which is found in the Island of Rhodes; and a kind of clay which is found in Italy will do the same. Pliny, who died A. D. 79, records the manufacture of soap as being composed of tallow and ashes, the best being made of goats' suet and beechwood ashes. That the amount of mineral matter in water, as effecting the condition of health, was studied at a very early period, is known from the fact that the hydrometer was probably first used for the purpose of ascertaining the quality of the water used for diedetic purposes. Although the principle of the hydrometer has been ascribed to Archimedes, there is no record of this instrument having been made by him. The earliest record, according to Beekman, appears from a correspondence between Synesius and Hypatia, the latter of whom was assassinated A. D. 415, in which Synesius states that he found himself so ill that he proposed to use the hydrometer, and requested Hypatia to at once procure one for him. The mode of strengthening ordinary lye by the addition of lime was known in the time of Paulus Ægineta, a physician who flourished either in the third or seventh century.

Soap is mentioned by Geber in the second century, and at a later period is frequently referred to by Arab writers, as being used not only for detergent purposes, but also for external application.

Soap is very largely used, or rather wasted, in many places in the present day for softening water, for which it is now well understood that no useful effect in washing is produced until sufficient soap has been used as will soften the water.

For the purpose of this investigation, water may be divided into two classes, hard and soft. Hard water is a water which contains salts of lime, magnesia, or iron, and sometimes an amount of free carbonic acid. A hard water, commonly considered, is one that destroys soap in washing, while a soft water is one that does not destroy soap. A soft water may derive its properties from an absence of earthy salts, or it may have become soft by reason of the presence of certain alkaline salts in the water, notably the salts of soda and potash.

Hard Waters may be divided into two classes, those which are permanently hard and those which are temporarily hard. Generally it is found that a single sample of naturally hard water partakes of both these properties. A water which is said to be temporarily hard becomes soft by boiling, as the hardness is due to salts of magnesia or lime dissolved in the water by the agency of carbonic acid, or due to the presence of this gas in a free state in the water. Under either circumstances, the effect of boiling the water a sufficiently long time is to drive off the carbonic-acid gas, and a natural softening of the water takes place from the absence of this gas and the earthy salts that have been held in solution by it in the water.

Water that is perfectly hard derives this property from the presence of the same salts as under water temporarily hard, but instead of being combined with carbonic acid, they are combined with sulphuric acid, and to soften water that is permanently hard requires very different conditions that in the case with waters that are only temporarily hard.

The qualities of a good drinking water have been described as:—

1. Freedom from vegetable and animal matter.
2. Pure aëration.
3. Softness.
4. Freedom from earthy mineral or other foreign matter.
5. Coolness and delivery at the minimum temperature.
6. Lucidity or clearness.
7. Absence of taste and smell.

Although many authorities insist that for the sake of health a soft water is beneficial, on the other hand, there are those who contend that there is no evidence whatever to show that even a hard water has any influence upon health. It is clear, so far as the health statistics of this country are concerned, that if anything the results come in favor of persons inhabiting districts having hard waters. On the other hand, it has been thought that particular diseases which affect particular localities are due to certain salts of magnesia, which have been found in the waters of the district. Some waters which are of remarkable softness is due to the presence of certain alkaline salts, especially those of soda, may be quite unfit for drinking purposes. A type of this water is found in the well supplying the Trafalgar Square fountains, as it is stated by some authorities that the large amount of soda contained in it, if taken habitually, acts medicinally upon the kidneys. It is also unfit for washing as the water is liable to destroy certain colors, and stain glass. It is said to be unfit for bathing, as the soda combines with the oily matter of the skin, produces a roughness and liability to chapping. Water, however, which is naturally soft, or which has been softened by means of a process like Dr. Clark's, which does not add any new element to the water, has great advantages for many purposes. It prevents incrustation of steam-boilers and household utensils, it results in a saving of fuel, less wear and tear in washing linen, and in the labor of cleansing; it saves soap in all washing and cleansing operations, the water cleans better, and gives a better color to linen, and it is also stated to lead to greater economy in tea-making and brewing; but whether this is correct or not is very doubtful, as water used for such purposes is always boiled, and when used in that state should be as soft as softened water.

The processes which have been used both in ancient and modern times may be comprised under the heads of Boiling, Chemical Processes, Distillin*r*, Exposure, Freezing.

Softening by Boiling.—Pliny, in his "Natural History," states that "water that hath been once sodden, that is, boiled, is far better than that which is raw." There is little doubt that the boiling of water, both as a means of reducing its hardness and also to effect its purification, was very extensively practised in ancient times, and the practice of boiling water is still carried on amongst some of the older nations, such as China and parts of India, with the greatest possible advantage, both from an economical and sanitary point of view. The Emperor Nero (A.D. 50 to 68) both boiled water for drinking purposes, and subsequently cooled it in glass vessels to which snow was externally applied. The effect of boiling water is to liberate the carbonic acid which holds certain alkaline salts in solution, and on the liberation of the acid these salts are precipitated and form the coating which furs our kettles, accumulates in our boilers, blocks the circulating-pipes of our water-heating apparatus, and is often a source of danger, and always of expense. The effect of boiling water, in order to soften it, can only be secured when this operation is sufficiently prolonged. The Commissioners appointed to inquire into the chemical properties of the water of the metropolis in 1851, made some experiments on the effects of boiling an artificially-prepared hard water, containing 13-5 grains of carbonate of lime per gallon, and it was found to decrease in hardness from 13-5° to 11-2° by being heated to the boiling-point; after boiling for five minutes it was reduced to 6.30, for fifteen minutes to 44° for 30 minutes to 26°, and for one hour to 24°, so that the softening effect does not take place at once, but a prolonged boiling is required in order to produce the greatest degree of softening. In order to get rid of the temporary hardness of water, sharp boiling for not less than twenty minutes is requisite, but boiling water does not remove the hardness occasioned by the salts which are neutral; in fact, the permanent hardness of the water is increased by boiling, as all the water evaporated leaves a concentration of the neutral salts in the remaining water. It has also been shown that the alkalinity of water is more after boiling than when softening has been produced by an alkaline salt such as lime, but both have the effect of reducing the hardness to about the same degree. This increase of alkalinity after boiling is attributed to the concentration of the neutral salts consequent on the loss by evaporation. The temporary salts held in solution by water are precipitated by boiling, and it is these precipitated salts which cause the furring of kettles, hot-water boilers, steam-boilers, and hot-water pipes, and have led to the adoption in certain cases of means either for retaining the salts in solution in the water or of preventing their deposite in steam-boilers, but as a rule with only partial success.

Chemical Processes of Softening Water.—In a paper read before the Literary and Philosophical Society of Manchester, in 1781, by Thomas Henry, F. R. S., a description is given of a mode of preserving sea-water by means of quicklime, in which the author pointed out that the earthy base of magnesia was precipitated in sea-water by lime, and its place taken by a calcareous salt. He also referred in his paper to the well-known action of quicklime on common water as a preservative. The effect of the lime, doubtless, upon the sea and fresh water was to induce abundant precipitation, which dragged down with it certain organic impurities, and, as a consequence, the water remained free from putrefactive influence afterwards, as we was clearly shown in the course of his experiments.

The first patent for purifying water by chemical agency in this country was taken out in 1838, for precipitating by muriate of zinc and salts of soda, the latter salts precipitating the

zinc from the water, leaving the water in a purified state.

In 1841 Dr. Thomas Clark, of Aberdeen, took out a patent for his well-known and beautiful process for softening water, which has, more or less, been the basis of all other patented processes of this description which have been adopted since that period. Dr. Clark thus describes his process, in a paper published in the *Journal of the Society of Arts* May 16, 1856:—

"In order to explain how the invention operates, it will be necessary to glance at the chemical composition and some of the chemical properties of chalk, for, while chalk makes up the great bulk of the matter to be separated, chalk also contains the ingredient that brings about the separation. The invention is a chemical one for expelling chalk by chalk. Chalk, then, consists, for every 1 lb. of 16 oz., of lime 9 oz., carbonic acid 7 oz.

"The 9 oz. of lime may be obtained apart by burning the chalk, as in a lime kiln. The 9 oz. of burnt lime may by dissolved in any quantity of water not less than 40 gallons. The solution would be called lime-water. During the burning of the chalk to convert it into lime the 7 oz. of carbonic acid are driven off. This acid, when uncombined, is naturally volatile and mild; it is the same substance that forms what has been called soda-water when dissolved in water under pressure.

"Now, so very sparingly soluble in water is chalk of itself, that probably upwards of 5,000 gallons would be necessary to dissolve 1 lb. of 16 oz.; but by combining 1 lb. of chalk in water, with 7 oz. additional of carbonic acid—that is to say, as much more carbonic acid as the chalk itself contains—the chalk becomes readily soluble in water, and, when so dissolved, is called bicarbonate of lime. If the quantity of water containing the 1 lb. of chalk with 7 oz. additional of carbonic acid were 400 gallons, the solution would be a water of the same hardness as well-water from the chalk strata, and not sensibly different in other respects.

"Thus it appears that 1 lb. of chalk, scarcely soluble at all in water, may be rendered soluble in it by either of two distinct chemical changes; soluble by being deprived entirely of its carbonic acid when it was capable of changing water into lime-water, and soluble when combining with a second dose of carbonic acid, making up bicarbonate of lime.

"Now, if a solution of the 9 oz. of burnt lime, forming lime-water, and another solution of the 1 lb. of chalk and the 7 oz. of carbonic acid, forming bicarbonate of lime, be mixed together, they will so act upon each other as to restore the 2 lbs. of chalk, which will, after the mixture, subside, leaving a bright water above. This water will be free from bicarbonate of lime, free from burnt-lime, and free from chalk, except a very little, which we keep out of account at present for the sake of simplicity in this explanation. The following table will show what occurs when this mutual action takes place:—

AGENTS.		PRODUCTS.		
Bicarbonate of lime in 400 gals.	Chalk	of chalk 16 oz.	=16 oz.	=2 lbs.
	with carb. acid	7 oz.		
Burnt lime in 40 gals. of lime-water		9 oz.	=16 oz.	

"A small residum of chalk always remains not separated by the process. Of 17½ grains, for instance, contained in a gallon of water, only 16 grains would be deposited, and 1½ grain would remain. In other words, water with 17½ degrees of hardness arising from chalk, can be reduced to 1½ degree, but not lower.

"These explanations will make it easy to comprehend the successive parts of the softening process.

"Supposing it was a moderate quantity of well-water from the chalk strata around the metropolis that we had to soften, say 400 gallons. This quantity, as has already been explained, would contain 1 lb. of chalk, and would fill a vessel 4 feet square by 4 feet deep.

"We could take 9 oz. of burnt-lime made from soft upper chalk: we first slack it into a hydrate by adding a little water. When this is done, we would put the slaked-lime into a vessel where we intend to soften them gradually, add some of the water in order to form lime-water. For this purpose at least 40 gallons are necessary, but we may add water gradually till we have added thrice as much as this; afterwards we may add the water more freely, taking care to mix intimately the water and the lime-water or lime. Or we might previously form saturated lime-water, which is very easy to form, and then make use of this lime, putting in the lime-water first and adding the water to be softened. The proportion in this case would be one bulk of lime-water to ten bulks of the hard water.

"It is of importance that the lime, or lime-water, that is the softening ingredient, be put into the vessel first, and the hard water gradually added, because there is thus an excess of lime present up to the very close of the process, and this circumstance is found to render the precipitation of carbonate of lime produced in the process more easy.

"But what you will wish to know is, by what mark is the conductor of the process to find out when there is enough of water to take up the last of the excess of lime, so as to be enough, but no more.

"This is done by what has been called the silver-test, the only test necessary to the operator after the process is fairly set a-going. This test is a solution of nitrate of silver, in twice-distilled water, in the proportion of 1 oz. per pint. In making use of the silver-test with ordinary waters we get a white precipitate; but if the water have in it a notable excess of lime-water, there is a light reddish-brown precipitate produced; but if the excess be very slight we only get a feeble yellow precipitate. The way we make use of the test is to let two or three drops of it fall on the bottom of a white tea-cup; then add the water somewhat slowly; then, if there be the slightest excess of lime, a yellow color will show itself."

"It may be here mentioned that a more delicate test than the silver-test for ascertaining if there is an excess of lime in the water consits in using a solution of cochineal, the natural color of which is yellowish-red, which is turned violet in the presence of alkalies; and other agents are now used to show, by distinct color or its absence, if there is an excess or not of lime in the softened water."

According to Dr. Clark's scale, 1° of hardness means that there is 1 grain of chalk in a gallon of water. According to the scale introduced by Dr. Frankland, in the sixth report of the Rivers Pollution Commissioners, parts per 100,000 are used, or 1 grain of chalk in 100,000 grains of water, so that it is necessary, in considering the reports of the Rivers Pollution Commissioners, to bear in mind this difference of degrees of hardness. To reduce the hardness to parts per gallon, or to the Clark scale, it is necessary to multiply by 7 and divide by 10.

Hard water decomposes soap. The amount of soap ascertained by Dr. Clark to be wasted before softening the water is equivalent to 2 oz. for each degree of hardness for every 100 gallons. Dr. Clark introduced a soap-test, or a means by which a solution of soap is made to at once indicate the degree of hardness of a water. When pure chalk is burnt into lime 1 lb. is converted into 9 oz. of lime, and this quantity is soluble in 40 gallons of water. Beyond this, lime is not soluble in water, so that clear lime-water always possesses a known composition. This amount of lime is equivalent to 98.43 grains per gallon. As one particle of lime will remove $\frac{1}{0.56} = 1.777$ of chalk, it follows that $98.43 \times 1.777 = 174.9$, or the number of gallons of water 1° of hardness which 1 gallon of lime-water will soften. In practice, however, while theoretically 175 gallons of water of 1° of hardness may be softened by 1 gallon of lime-water, owing to the impurities in the lime, probably not more than 140 to 150 gallons would be softened, so that, to arrive at the amount of lime-water necessary to soften hard water, if we divide 150 by the degrees of hardness according to Clark's scale, it will, generally, roundly represent the number of gallons of water which can be softened by 1 gallon of lime-water.

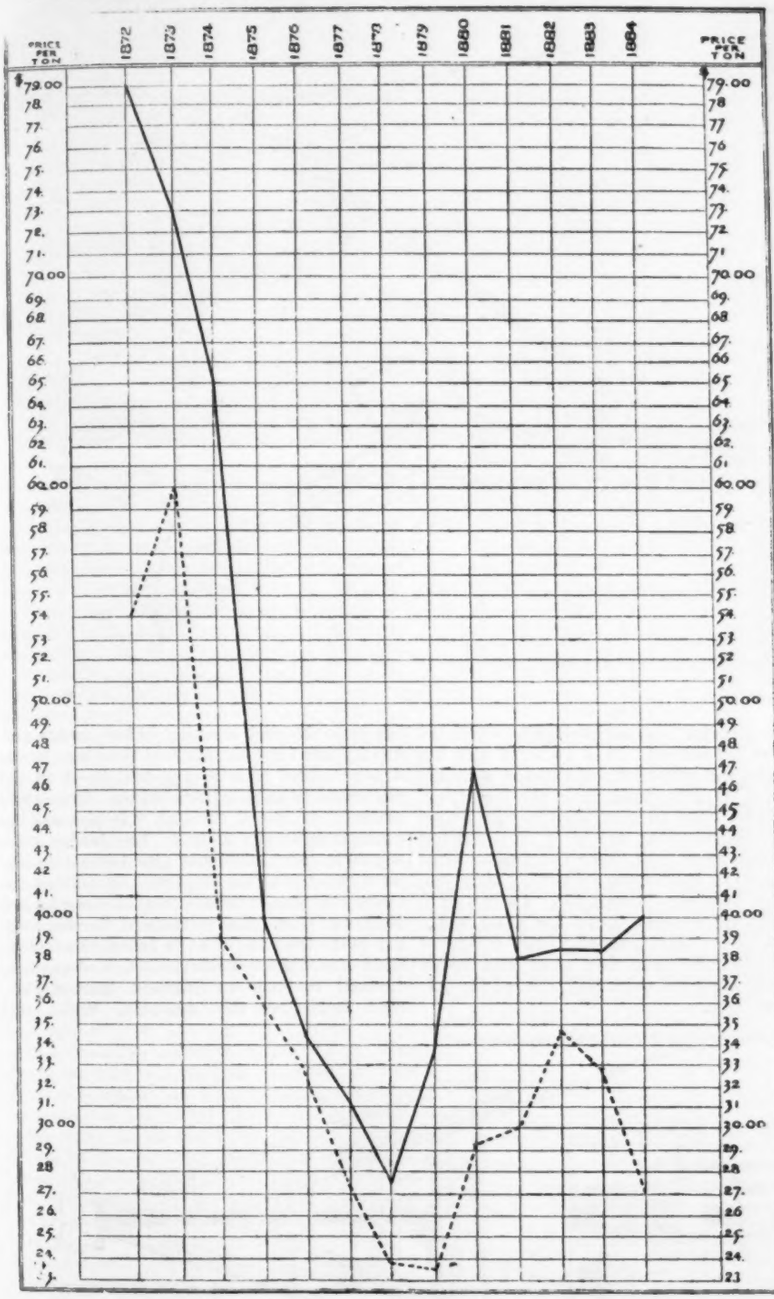
(TO BE CONTINUED.)

House Building In Buenos Ayres.

The building trade in the City of Buenos Ayres, says the *South American Journal*, is very active, and, although this has been the case during the past four years, rents are rising, and the demand for houses, shops, and warehouses much exceed the supply. The city has an estimated population of between 200,000 and 300,000, and the size of the built-on ground is about five miles by three, but there are roads leading out to the suburbs extending some six or seven miles. The city is regularly laid off in streets, which cross each other at right angles. These streets are about 150 yards apart, and for the most part are not above 30 ft. to 35 ft. wide. There are no mews lanes between the streets, which causes much loss of ground and inconvenience, as carriages, horses, and all rubbish have to be taken through the front doors. The site is nearly flat, and, as a large number of the houses are of one story and of very common character, the appearance of the town is far from prepossesing. A curious feature is that there are almost no fashionable or select localities, and the palaces and hovels, colleges and workshops, first class shops and market places adjoin in mingled succession. The usual plan is the Spanish or Moorish. The rooms are built round internal open courts, and all open into a piazza surrounding the court, and communication is obtained by doors glazed in the upper part: the roofs are flat. The plan is well suited for the summer, but is not so comfortable in the winter months, especially as many houses have no fireplaces. It is wasteful of space, and gives houses usually too large and expensive for families of moderate means. The common building material is brick, made near the city, the usual size being 12 in. by 6 in. by 2 in. Lime is burnt near the city. Stone has to be brought from the Banda Oriental. Native marble of good quality is found, but the greater part of that used comes from Italy; notwithstanding this, marble is lavished on construction. Some of the fine houses are actually encased in white marble slabs, whilst the most ordinary houses have plinths, window-sills, stairs, and hall pavements of this material. Pine timber has been imported from North America, but the country has abundance of hard wood and cedar. Cement and flat tiles, as well as all fireclay goods, are imported from Europe. The building trade is at present almost entirely in the hands of Italians and Spaniards, although there are a few architects of other nationalities who do very well, having generally a good connection; but frequently the same person combines the trade of architect and builder. In many cases these are men risen from the ranks of workmen, and who sometimes build without plans.

MOOSEHEAD LAKE BRIDGE.—The scheme of the Lake Megantic Railroad Company to bridge Moosehead lake, will be strenuously opposed by the people of Bangor, who practically own the Bangor & Piscataquis railway, running from the Queen City to Greenville at the foot of the lake, and the business of which would be interfered with by an opposition line. It is probable now that there will be a sharp contest over the matter. It is asserted that the Bangor & Piscataquis road is paying a fair dividend on $1,000,000, and a prominent gentleman Penobscot says that the Bangor folks would be willing to have the road sold at a figure less than $1,200,000.—*Augusta Me., Journal.*

HIGHEST AND LOWEST PRICES OF CAST-IRON WATER PIPE, 1872, 1884.



Highest and Lowest Prices of Cast-iron Water Pipe; 1872, 1884.

The diagram shown above is furnished us by Charles G. Darrach, Hydraulic Engineer with Wilson Bro's. of Philadelphia. The full line represents the highest, and the dotted line, the lowest average price per ton during the several years from 1872 to 1884. The price used in making the diagram is an average price between pipes of, say, 4 in. and 30 in. diameter.

The Slate Fields of Pennsylvania.

Few people have any idea of the magnitude of the slate industry in this country. Until a few years since, the product of the different slate quarries in the United States was quite limited. Now the total amount produced, of roofing-slate alone, is about 500,000 squares per year. A 'square' is 100 square feet, or sufficient to cover a space 10 feet by 10 feet, when laid on the roof. It covers the same area as 1,000 shingles, and sells for from $3.50 to $4.50 per square.

Most of the quarries are in eastern Pennsylvania—in Northampton and Lehigh counties. More than one half of the total product of the United States comes from that region. Maine and Vermont produce small quantities, there are also small beds of slate in Michigan and Virginia. The quarries at Bangor, Pa., in Northampton County are considered superior to any, as the slate is tough, durable and of an unfading dark blue-black color. The quarries there are valued at from $50,000 to $500,000 each.

Over 3,000 men are employed in eastern Pennsylvania, and the number is fast increasing, as new quarries are opened and developed. The workmen are mostly Welsh and English. They earn good wages, have comfortable homes and are a happy, sober and industrious class.

The slate is first blasted out, then hoisted by steam power in large irregular-shaped blocks to the bank. These blocks are then broken or "scalloped" into smaller blocks; then split into sheets of required thickness. For that purpose a chisel or knife about 18 inches long, resembling a large putty-knife is used. The slate splits readily wherever the knife is put in, if inserted when the block is wet or "green," as it is called. The workmen speak of the original moisture in the slate as "sap." After the blocks are dry they harden and cannot be split.

After the blocks are split the sheets are dressed or trimmed with a machine, worked by foot-power to the required size, which is from 6 by 12 inches to 14 by 24 inches. They are then shipped to all parts of the Union and to the Old World. A great deal of slate goes to Australia. When beds are found the slate is in inexhaustable quantities, and improves in quality as the depth of the quarry increases.

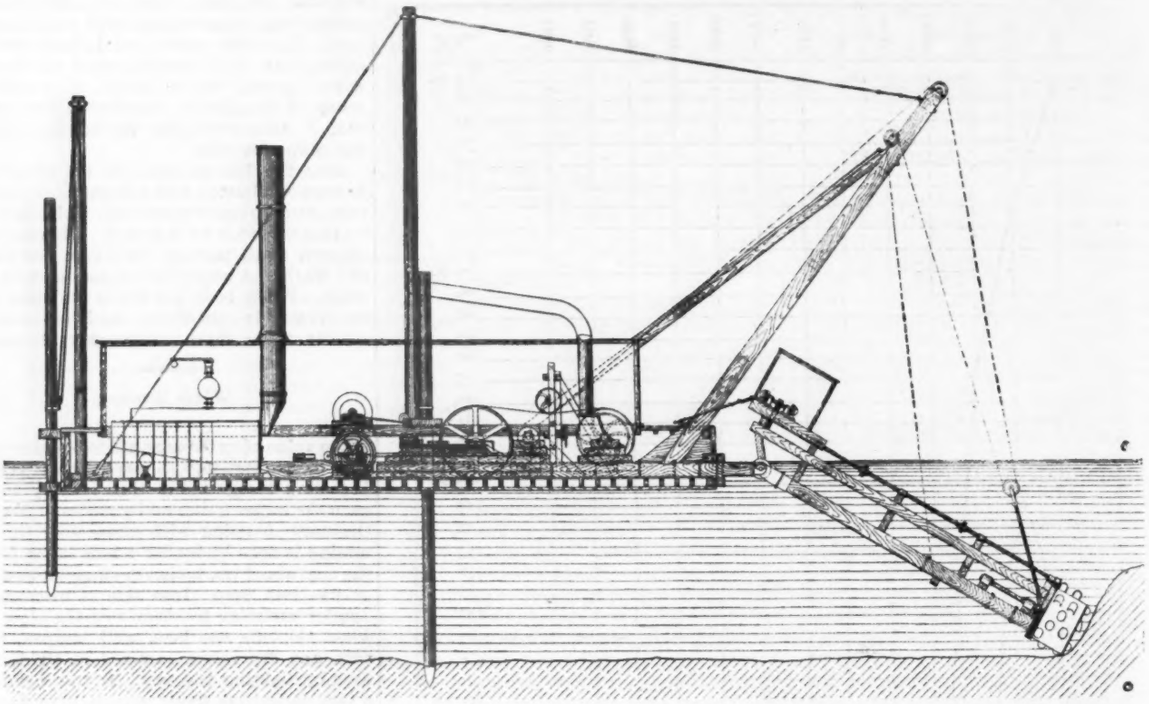
Water Blasting.

The value of water as an aid to blasting when used in connection with explosives is rapidly becoming recognized in this country as well as in the larger mines and quarries of Europe. Ordinary blasting with gunpowder in coal mining is done by boring a hole in the face of the coal about two inches in diameter and four or five feet deep. Into this is inserted the powder cartridge together with the slow fuse when the hole has been well tamped, filled with any dry refuse rammed in tight, then fired by lighting the fuse. In this operation a very dangerous flame, especially in gaseous pits, is created, and appalling results often ensue; carbonic acid and sulphurous acid gases are generated very dangerous to miners and to mining properties.

When it is desired to blast with water together with gunpowder, the process is conducted by inserting into the bore-hole a powder cartridge with the fuse attached as in the ordinary way; next to the powder cartridge is inserted into the bore-hole a tube containing water. These tubes must be as large as the bore-hole will admit, and of any length convenient to handle, the larger the better, they may be made of any cheap material, convenient, cheap thin tin plate, or of stout brown paper turned round on a wooden roller, after being well pasted together, the ends closed with corks. The bore-hole is now tamped in the ordinary manner, the fuse lit, and the cartridge fired in the usual manner; as a result of this process the following points of excellence, among many others, may be briefly mentioned: The powder, in exploding, bursts the tube containing the water, and careful estimates show with increased power or explosive violence, as the rending force is extended through the water in accordance with the well known principle of hydrostatics practically demonstrated years ago by Bramah, over the enlarged interior area of the bore-hole, due to the space occupied by the water tube. A much larger quantity of the material to be mined or quarried is thereby brought down or loosened with a smaller quantity of the explosive used; the heat given off by the burning of the powder and surrounding gases converts a large proportion of the water into steam, the elastic force of which assists in the operation of blasting; the steam and remaining water together extinguish the flame and flash of the powder, and absorb and neutralize the greater portion of the gases and smoke resulting from the explosion.

A VERY simple contrivance—but at the same time a very valuable one—is being placed in the switches, frogs, and guards of the Old Colony Railroad. It consists of a piece of hard wood so shaped and bolted to a rail as to prevent a person's foot from getting caught in the groove when on the track. Accidents of that kind are of daily occurrence.—*Fall River (Mass.) News.*

FIG. 1.—ATLAS DREDGE, SIDE ELEVATION.



The "Atlas" Dredge.

The Atlas dredge, illustrated in this issue, resembles the Hercules (See ENGINEERING NEWS Feb. 3, 1883,) inasmuch as it is designed to float, cut its own channel, dredge from the front of the machine, and to be moved by a system of pivoting spuds, shore lines etc. But the method of cutting, lifting and discharging the material is very different.

In the Atlas dredge the cutter is a wrought-iron cylinder, 8 feet in diameter and 5 feet deep, or long; one end of this cylinder has a boiler-iron head, the other end overlaps the circular cast-iron disk which forms the lower end of the ladder or frame-work carrying the cutting machinery, and to this iron disk is attached the gearing for driving the cutters. In the cylinder and its outer end are openings, about 12 inches wide, by 24 inches long, and over these openings are fastened steel buckets, formed so as to cut at the best angle when brought into contact with the bank, and to force the excavated material inside the cylinder, and so disposed over the surface of the cylinder as to include the entire area of the bank covered by the cylinder at each revolution of the cutter.

Through the stationary iron disk, at the foot of the ladder, is an opening 20 inches in diameter, and through this opening, and projecting into the cylinder, is a suction-pipe by which the material is removed. This piece of pipe has the under side removed, for a space 20 inches wide and 30 inches long, from the lower end. The under side of this suction-pipe comes within 8 inches of the inside of the cylinder, so that all clods and other substances must be reduced to that diameter before they can enter the pipe and be removed. To facilitate this breaking process there are steel teeth, about 7 inches long, fastened to the inside of the cylinder, and these tear apart and break all larger masses of mud, clay, etc., as the cylinder revolves.

The cylinder itself is connected to a strong shaft which passes through a stuffing box in the stationary disk, and is supported upon the ladder by two other thrust boxes. The cylinder is supported on its inner end by overlapping, in close contact, the iron disk supporting the gearing. The cylinder is made to revolve, by means of this gearing and its shaft, the motive power being supplied by an engine carried on the inner end of the ladder; the steam pipes supplying this engine are jointed to permit the placing of the dredge-ladder at any required angle.

The excavated material is removed from the inside of the cylinder by suction, produced either by a centrifugal pump or a suction fan on the dredge boat. The 20-inch suction pipe, leading from the disk opening before mentioned, has a jointed double-elbow at the hinge in the dredge-ladder to accommodate itself to the variations in angle of this ladder. The raised material is passed through this pipe and the pump to any point desired. The dredge is designed to carry 150 feet of pipe beyond its center without exterior support; beyond that distance, pontoons or trestles must be used for the discharge pipe. The distance of the discharging point from the boat is practically unlimited; one of these machines is now depositing dredged material in Oakland Harbor, Cal., 3,000 feet from the machine. While this method of discharge is well known and in use before, the mechanism of preceding machines was not adapted to bringing the cut material to the suction pipe, there was no check upon the flow of water in the pipe, and the quantity of water passing was greatly in excess of the solid material. In the present machine the method of working may be described as follows: The cutting cylinder is first sunk into the bank so that its top is below the water surface; the main engines then set the centrifugal pump in motion, and the auxilliary engines on the dredge-ladder cause the cutting cylinder to revolve. The dredge is moved about the center spud as a pivot, through a radius of about 150 feet and the width of the channel desired, by means of the drum-lines and anchors. The

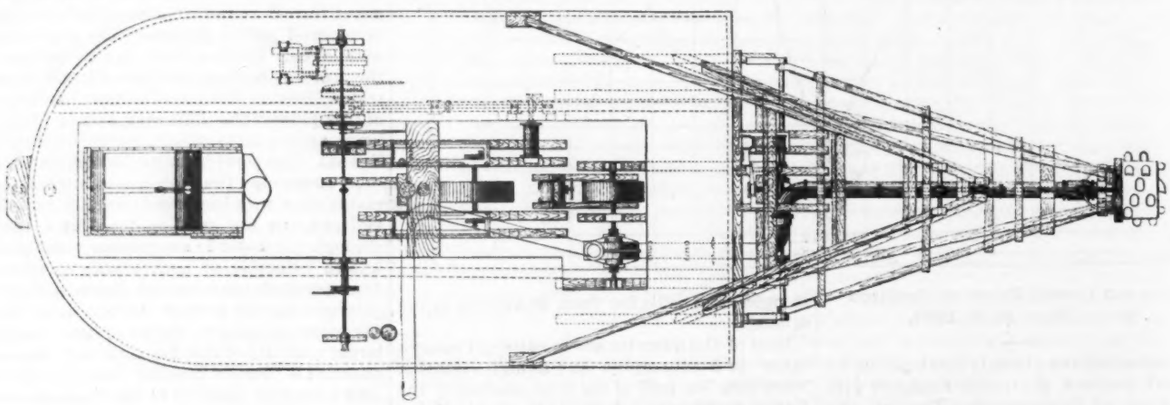
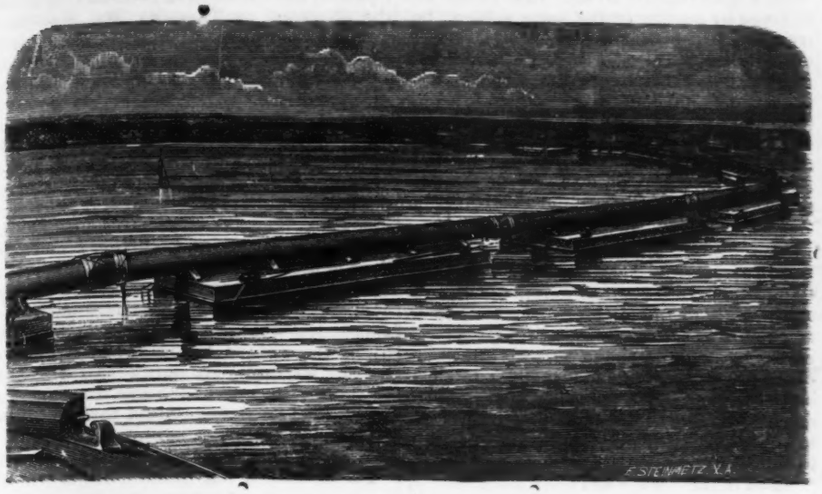


FIG. 2.—ATLAS DREDGE, PLAN.

FIG. 3. DELIVERY PIPES USED WITH ATLAS DREDGE.



excavated material meanwhile falls into the cylinder and is sucked out through the 20-inch pipe, passes through the pump and is deposited at any desired point. When one cut or sweep is made, the cutting cylinder is lowered and the operation repeated back to the point of beginning. One of the great advantages of this type of dredge is that it can attack a bank rising above the water level by undermining it just below the surface and thus causing the bank to fall. Separate engines are used for handling the dredge and in raising and lowering the dredge-ladder; this independent arrangement makes it possible to so regulate the dredging engines proper as to adapt them to each other in rate of speed and to the material to be excavated.

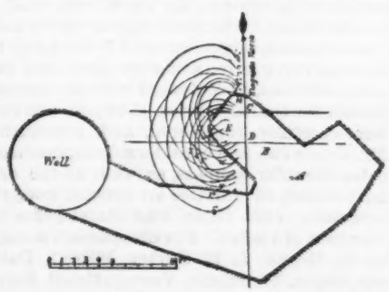
This dredge will operate very successfully in mud, sand and clay mixed, or any non-fibrous material; and the only limit to its work is the capacity of the pumping and cutting engines. This plan of dredging is based upon the theory that the material will flow, and the quantity of water mixed with it can be regulated, within certain limits, by the necessity of the case. In ordinary cases the solid material will average from 20 to 40 per cent. in volume of the whole quantity passing through the pipe. The pump used on this machine is rated at 15,000 gallons of water per minute, which reckoned at 7½ gallons per cubic foot, would aggregate 4,444 cubic yards per hour; of this amount about 900 to 1,600 cubic yards may be classed as solid material. With the large percentage of water carried, the material will spread over a very considerable area at the point of discharge. It works admirably in canal or harbor construction, where the material can be deposited on land within one mile of the machine.

One man, stationed upon an elevated bridge on the dredge, can, by a system of levers and connections there centering, raise and lower the ladder and spuds, feed the machines from side to side or ahead, and regulate the speed and working of the various engines.

The Atlas dredge is patented and built by the Golden State and Miners Iron Works, of San Francisco, Cal., the builders of the Hercules dredgers at Panama, and the Von Schmidt dredge illustrated in ENGINEERING NEWS of Jan. 10, and using the same system of delivery pipes as the one now described. This Atlas machine is now at work in Oakland Harbor, California, and in September last finished a cut across the river 1800 feet long, 90 feet wide and 10 feet deep in 25 days, working generally 12 hours per day. During the first week an average of about one hour per day was lost by the cutter coming in contact with willow roots which interfered with the pump and necessitated frequent stops to clean it out. The material removed aggregated 60,000 cubic yards, or 2,400 cubic yards per day, or about 240 cubic yards per hour, including all detention. The material upon which this machine is now operating in Oakland Harbor has defied the best efforts of all other dredges to remove it; the contractors claiming that it may be classed as a fair sand-stone. The Atlas nevertheless is excavating it. For any further data concerning this new dredge, parties are referred to Mr. Cyrus Palmer, 155 Temple Court, New York.

Finding a Bore Hole.

In sinking a well at the Holyrood Brewery of Messrs. William Younger and Co., Edinburgh, it was considered necessary, after the bore hole had gone down 200 ft., to connect it by a mine with a neighboring well 18 ft. 3 in. distant, centre to center. The miner was entrusted with the work, but owing to one of his plumb-lines not hanging vertically, he cut his gallery in the wrong direction and failed to find the bore hole. A mining engineer was then sent down, and he showed where the hole ought to have been, but as it was not to be found at that spot, it was evident that it had



diverged from the vertical. The ground had already been cut away all round the place, and an unsuccessful attempt had been made to locate the hole by the device of listening while the rods were shaken within it. It therefore appeared that large quantities of ground might have to be excavated before the hole could be found. At this point Mr. Andrew Haddow, engineer to Messrs. Younger and Co., took up the question, and located the hole by an extremely ingenious and, we believe, perfectly novel device. Referring to the accompanying engraving, A represents the place where the bore would have been found if it had descended vertically, and where it had already been sought. A space of 3 ft. was cut out all around this spot, and the mine extended 6 ft. further before Mr. Haddow attempted to indicate the position of the hole by the happy device of passing a magnet down it, and noting its effect on a compass stationed in the mine. He procured four 8 in. bar magnets, which he put end to end secured between two laths of wood. These were lowered into the bore with the south pole downwards. The north end of the compass needle moved first to the west, then to the east of zero, which showed that the magnets were on the west side of the compass, and led to the mine B being cut. While this was proceeding Mr. Haddow set the compass on a table and passed the magnet round it; finding a number of points on the floor where the deflection of the needle equalled ½ deg., he then drew a line through the points found. He did the same for other deflections and thus produced a series of curves. The compass was then stationed at the points C and D in the mine and the deflections noted. The points C D were marked on the plan and a tracing of the magnetic curves set over each point as shown. The observed deflection at C was 3¼ deg., and at B, 6½ deg. The bore E was found where the curves corresponding to these deflections crossed one another, being about 8 ft. from the expected position. [Engineering.]

Foreign Coins.

Estimate of values of foreign coins, giving country, monetary unit, standard, value in United States money, and standard coin:

Argentine Republic, peso, gold and silver, .96,5—1-20, 1-10, 1-5, 1-2 and 1 peso, 1-2 argentine and argentine.

Austria, florin, silver, .39,3

Belgium, franc, gold and silver, .19,3—5, 10 and 20 francs.

Bolivia, boliviano, silver, .79,5—boliviano.

Brazil, milreis of 1,000 reis, gold, .54,6

British possessions in North America, dollar, gold, $1.

Chili, peso, gold and silver, .91,2—condor, doubloon, and escudo.

Cuba, peso, gold and silver, .93,2 -1-16, 1-8, 1-4, 1-2 and 1 doubloon.

Denmark, crown, gold, .26,8—10 and 20 crowns.

Ecuador, peso, silver, .79,5—peso.

Egypt, piaster, gold, .01,9—5, 10, 25, 50 and 100 piasters

France, franc, gold and silver, .19,3—5, 10 and 20 francs.

German Empire, mark, gold, .23,8—5, 10 and 20 marks.

Great Britain, pound sterling, gold, $4.86,6½—1-2 sovereign and sovereign.

Greece, drachma, gold and silver, 19,3—5, 10, 20, 50, and 100 drachmas.

Hayti, gourde gold and silver, .96,5—1, 2, 5 and 10 gourdes.

India, rupee of 16 annas, silver, .37,8.

Italy, lira, gold and silver, .19,3—5, 10, 20, 50 and 100 lire.

Japan, yen, silver, .85,8—1, 2, 5, 10 and 20 yen, gold and silver yen.

Liberia, dollar, gold, $1.

Mexico, dollar, silver, .86,4—peso or dollar, 5, 10, 25 and 50 centavo.

Netherlands, florin, gold an l silver, 40,2.

Norway, crown, gold, .26,8—10 and 20 crowns.

Peru, sol, silver, .79,5—sol.

Portugal, milreis of 1000 reis, gold, $1.08—2, 5 and 10 milreis.

Russia, rouble of 100 copecks, silver, .63,6—1-4, 1-2 and 1 rouble.

Spain, peseta of 100 centimes, gold and silver, .19,3—5, 10, 20, 50 and 100 pesetas.

Sweden, crown, gold, .26,8—10 and 20 crowns.

Switzerland, franc, gold and silver, .19,3—5, 10 and 20 francs.

Tripoli, mahbub of 20 piastres, silver, .71,7.

Turkey, piaster, gold, .04,4—25, 50, 100, 250 and 500 piasters.

United States of Colombia, peso, silver, .79, 5—peso.

Venezuela, bolivar, gold and silver, .19,3—5, 10, 20, 50 and 100 polivar.

TREASURY DEPARTMENT.
WASHINGTON, D. C., Jan. 1, 1885.

The foregoing estimation, made by the Director of the Mint, of the value of the foreign coins above mentioned, I hereby proclaim to be the values of such coins expressed in the money of account of the United States, and to be taken in estimating the values of all foreign merchandise, made out in any of said currencies, imported on or after January 1, 1885.

H. MCCULLOCH,
Secretary of the Treasury.

MASSACHUSETTS has 1973 miles of railway, of which 667 miles are double track. Of street railways there are 309 miles in the state. Last year the former carried 66,517,000 passengers, while the latter carried 95,000,000 passengers.

ENGINEERING NEWS for three months One Dollar.

Ohio Society of Surveyors and Civil Engineers.

The Sixth Annual Meeting of this active and flourishing organization was held in Columbus, Ohio, on the 13th, 14th and 15th inst. In consequence of thorough advertising by circular letter and the press, a large representation of the profession was in attendance, and throughout all the sessions exhibited the most lively and gratifying interest in the proceedings. The instrument makers were also out in force, and very materially added to the general interest and profit by their exhibits. It cannot fail to pay the manufacturers of instruments for engineers and surveyors, thus to meet in person, and in their most favorable mood, the most intelligent and doubtless the most wealthy (if we may use the term) of the users of their wares in such a State as Ohio, and to be able to discuss the merits of their several instruments direct, rather than through the tedious process of correspondence.

The Annual Meeting was opened on Tuesday the 13th by retiring President F. J. Sager, of Marysville, Ohio, who, after the reading of th report of the Secretary and Treasurer, Benjamin Thompson, introduced President elect J. B. Strawn, of Salem, Ohio, who, in taking the chair, delivere l his inaugural address.

A vote of thanks was then given to the retiring Presi lent for his untiring zeal and devotion to the interests of the society during the past years, not only of hisofficial term, but from the commencement of the organization.

The subject of incorporating the society, in accordance with the laws of Ohio, was then introduced by the Legislative Committee, and after discussion, it was decided to make application for articles of incorporation. Later, the committee, who took the matters in charge, consisting of J. B. Strawn, F. J. Sager, B. F. Bowen, Benjamin Thompson, and John B. Gregory, reported that the articles of incorporation had been secured, and all necessary legal steps taken, so that now the "Ohio Society of Surveyors and Civil Engineers" has a legal existence, can sue, and be sued, etc.

The first paper in the evening was on "Plate Girders," by M. J. Becker, Chief Engineer of the P. C. and St. Louis Railway, already published "by permission" in ENGINEERING NEWS.

The literature of this important subject is quite scanty, and the Ohio Society and the profession at large, are very much to be congratulated that so busy an engineer as Mr. Becker can be induced to contribute so valuable a paper for their benefit. It is to be hoped that the example thus set may be extensively imitated at future meetings of the Ohio and other State organizations of engineers.

"Transmission of Power," by R. F. Hartford, was next read and discussed. The paper was a comparison of the effective results of steam, compressed air and electricity, the author giving special attention to the last named power.

The subject matter, including the necessary formulas, were rather too abstruse for considerate comprehension, and the paper, considered a valuable one, will be better understood after its appearance in the printed Transactions of the Society. Mr. Hartford has made a specialty of Hydraulic engineering, and was an Assistant Engineer on Construction of the Memphis Sewerage system.

The meeting on Wednesday morning, the 14th, opened with the Report of the Drainage Committee, by E. D. Shreve, of Mansfield, O. The drainage interest is one of much importance to one-fourth of the State, and Mr. Shreve has taken great pains to collect all items of interest and statistics relating to drainage within the State, and his report, like its predecessor of last year, supplies a large amount of information that can be secured in no other way. The report was followed by a lengthy paper on "The Problem of Just Apportionment of the Cost of Ditch Improvements," by E. B. Opdycke, of Bryan, Ohio, and which was "by permission" published in full in last week's ENGINEERING NEWS. This paper was followed by another on the same subject, but from a different point of view, by J. L. Geyer, of Paulding, Ohio. The subject of apportionment was very thoroughly considered, and the three papers, taken together, present in a very complete way the methods used by different engineers throughout the State. The discussion was general and intelligent, and was continued until actually forced to a conclusion by the pressure of other business.

The first business in order, at the afternoon session, was the Report of the Committee on Land Surveying, by J. D. Varney, of Cleveland, Ohio. Mr. Varney had had sent to him several questions in regard to the proper method to be pursued in certain cases, and he read the replies he had sent, and took up the discussion of the principles, using a blackboard to elucidate matters and "reserving the right to change his mind the next minute." Problems in surveying practice are the favorite "stamping ground" of country surveyors, and the expounder of the "whys and the wherefores" of all the knotty cases which generations of pig-headed farmers, and ignorant surveyors, have placed in the note books of the existing surveyors, has no easy position to fill. But Mr. Varney is serenity itself, and what is unknown to him in the surveying line is exceedingly small. Whoever listened to his supreme effort of last year, the rhetorical beauties and elegant delivery of which still linger in our mind as a delightful memory amid much miserably cold discomforting recollections, will appreciate the calmness with which he met alike the avalanche of questions hurled at him by his eager listeners, and the noisy demonstrations of the "sausage grinder" on the floor just beneath him. Mr. Varney is the right man in the right place, and while he holds the chair of the committee on surveying practice, in his calm and ever serene grasp, the Ohio surveyors, and all the elements of disorder, may beat against him in vain. But even Mr. Varney must come to an end, and regretfully though we say it, yet his clear exposition of the science of how to reconcile the real estate differences of two or more German farmers, had to give way to the paper of Mr. Gyger, of Columbiana County, on the "Use of the Solar Transit in Land Surveying." Mr. Gyger being unable to be present, his paper was read by the Secretary. The paper was in short a discussion of the solar compass for the use of the land surveyor in retracing old lines and running new ones, as compared with the ordinary transit for similar service. The *pros* and *con's* were carefully considered, and, inasmuch as Mr. Gyger has had considerable experience in using the solar compass, as well as the ordinary transit, his opinions are entitled to weight, especially, with those who contemplate the purchase of a solar. The discussion was taken up by Messrs. L. E. Gurley, Witzell, Davisson, Geyer, Thompson, Varney, Cassil, Jarvis, Haller, *et al*, but soon turned to the question of monuments, decisions rendered, etc, etc.

According to programme, the evening and Thursday morning were to be devoted to the Mining Engineers' meeting, and sight seeing, but with the exception of those who attended the exercises of the Mining Engineers, the members preferred to remain at the place of meeting, forming new acquaintances, discussing questions of practice, examining the large and elegant display of engineering instruments by the Gurleys, by L. E. & W.F.Gurley, Young & Son, by their representative Mr. Watson; Beckman, of Toledo, the many maps, plans, specifications of work done and to be done, architectural designs, steel tapes, improved reels, new style folding leveling rods and tapes, record books, field books, blanks, forms, etc., *ad infinitum*.

Many members desiring to leave Columbus on Thursday night, and early Friday morning, it was decided to push matters along, and if possible, end the meeting Thursday night. In the afternoon on Thursday, Mr. Watson, of Young & Sons in behalf of his employers, presented the Society an elegantly finished copper plate map of the United States and Mexico, showing their relative positions to the rest of the world, in addition to the matter usually included in any good map. The Society accepted the gift, and tendered the donors a unanimous vote of thanks.

Mr. J. L. Culley, of Cleveland, O, then read a paper on "The Surveyor and his Field Notes," in which he described a system of abbreviations in use by all the surveyors of Cleveland, so that any one of them can take the notes of any brother surveyor and understand, at a glance, just what had been done, and he illustrated the method by drawings and blackboard. Mr. Culley strongly advocated the use of the foot and decimal parts thereof, as the standard of all measurements, to the exclusion of the present complicated system which allows rod, chain, line, yard foot and inch to be used.

The discussion was general, and some very interesting bits of information were brought out by votes on the questions: "How many use no measure except the chain and links? How many use no measure except the foot and multiples of it? How many use both? How many use steel tapes in place of the chain?" At present there is no uniformity, but the foot and steel tape are fast gaining ground.

The manufacturers of instruments were then allowed a short time to exhibit and explain the merits of the articles exhibited by them, and then the Society listened to a paper on "Land Description," by R. S. Weitzell, of Logan, O., in which the writer vigorously attacked the present custom of allowing Justices of the Peace, Attorneys with no knowledge of surveying, in fact anybody, to write deeds, without having them carefully examined by some competent person, prior to their being copied in the records of the county.

After this paper the Society listened to the report of the committee on Blanks and Instruments, and then adjourned for supper.

The evening session was in many respects the most enjoyable of all. The exercises were opened by a paper on the "Sanitary Arrangements of Public Buildings" at Mt. Gilead, O., by B. J. Ashley, Mt. Gilead. The problem was to prepare plans for an out-building with vault that would be self-cleansing, never clogging, inodorous, inexpensive, everlasting, and Mr. Ashley explained the plan adopted. The discussion was participated in by Messrs. Hartford, Strawn, Ashley, Shreve, Pugh and others. Apparently Mr. Ashley had adopted the best plans possible under the circumstances.

The next in order was the Report of the Committee on Civil Engineering. This Committee had so much to look after that it hardly knew where to begin, yet presented a creditable report, which was discussed by Randabaugh, Holl, Strawn, Hartford and others. The workings of the Memphis sewers, the workmanship in their construction and the practical results obtained were frequently referred to, and the faults briefly considered.

The Committee on Highways had been unfortunate during the year, the chairman having resigned, the next man having been prevented by severe sickness from doing anything, but at the last minute F. M. Davisson came to the rescue, and considered the present system of road improvement, and also the lack of system in keeping roads in repair. After discussion of the paper, which was read by the Secretary, the Society proceeded to transaction of business.

A telegram from the Nebraska Association of Surveyors, in session at Lincoln, Neb., wishing the Society continued prosperity, was received with applause, and the Secretary directed to reply by suitable letter. The Com-

mittee on qualifications for membership in the Society requested another year to make their report, which was granted.

A letter was received from F. Hodgman of Michigan, stating that the proposed Surveyor's Manual was about ready for publication, and it was ordered to be placed on file.

The Constitution was amended so as to conform to the laws of Ohio relative to incorporated bodies, and then adopted as the Constitution of the Society as incorporated.

A communication was read from the Boston Society of Engineers, urging the Society to join the Association of Engineering Societies, and was referred to the Board of Trustees to report upon at the next annual meeting.

A vote of thanks was unanimously tendered Messrs. Becker, Hartford, Opdycke, Geyer, Cully, Weitzell, Ashley and Gyger, for their papers, and it was further ordered that the Secretary retain the papers prepared and read before the Society for publication by the Society, before appearing in print elsewhere, and that copyright be secured. It was also ordered that all papers crowded out in the regular meeting, or that may be recived, be referred to the Secretary and Board of Trustees with power to incorporate such as they see proper in the Annual Report; that the Secretary may make exchanges of reports with other societies; and that the price of the Report to persons not members of the Society be fixed by the Secretary and Board of Trustees at the time of publication.

The officers of the Society were re-elected and are as follows:

President, J. B. Strawn, Salem, O.

Secretary and *Treasurer*, Benj. Thompson, Urbana, O.

Board of Trustees, F. J. Sager, Chairman, Marysville, O.

During the evening many amusing things occurred that kept the Society in a happy good humor, and made the time fly quickly, so that ere they were aware of it, the sixth Annual Meeting of the Ohio Society of Surveyors and Civil Engineers was a thing of the past.

At the close of the meeting, the register showed that the following persons had been present. Those marked with a * are new members:

B. J. Ashley, County Surveyor and Civil Engineer, Mt. Gilead, O.; Wm. Reeder, County Surveyor and Civil Engineer, London O.; J. Arnett, Civil Engineer, London, O.; J. L. Geyer, Civil Engineer, Paulding, O.; * E. W. Dimock, Chief Locating Engineer T. D. & I. Ry., Ottawa, O.; John P. Haller, Surveyor and City Engineer, Lima, O.; * D. P. Hudson. County Surveyor, Napoleon, O.; B. F. Bowen, Surveyor, Civil Engineer and Contractor, Columbus, O.; F, J. Sager, Civil Engineer, Marysville, O.; J. B. Strawn, Civil and Sanitary Engineer, Salem, O.; F. M. Priest, Co. Surveyor and Civil Engineer, Bryan O.; A. A. Cassil, City Engineer, Mt. Vernon, O.; * J. S. Bimby, Surveyor and Civil Engineer St. Clairsville, O.; * Geo. McGormley, Dep. County Surveyor and Civil Engineer, Tiffin, O.; J. R. Wright, County Surveyor and Civil Engineer, Georgetown, O.; R. S. Weitzell, Engineer and Surveyor, Logan, O.; W. H. Jennings, Engineer C. H. V. & T. Ry,, Columbus, O.; H. B. VanAtta, Engineer and Surveyor, Nelsonville, O.; * Edward Boggs, Engineer C. H. V. & I. Ry., Columbus, O.; F. A Bone, County Surveyor, Lebanon, O.; John B. Gregory, Engineer U. S. Surveys, Columbus, O.; J. A. Hosbrook, County Surveyor, Cincinnati, O.; D. S. Hosbrook, Civil Engineer, Cincinnati O.; W. D. Porter, Columbus, Ohio; Wm. P. Elliot, Monge Dredge Company, Chicago, Illinois. Benjamin Thompson, Secretary, Urbana, O.; Geo. L. Ruggles, with Seiburt & Lesley, Columbus,; E. B. Opdycke, Civil Engineer, Bryan O.; * R. F. Hartford, Civil Engineer, Columbus, O.; J. D. Varney, County Surveyor, Cleveland, O.; A. J. Robinson, Mechanical Engineer, Cleveland, O.; G. S. Innis, Surveyor and Civil Engineer, Cleveland, O.; Israel Underwood, Mt. Vernon.; O. * Charles F. Ferguson, County Surveyor, Sandusky, O.; * Thos. R. Wickenden, Engineer Smith Bridge Company, Toledo, O.; Thos. N. Watson, Instrument Maker, Philadelphia, Pa.; J. N. Headington, Surveyor and Engineer, Mt. Vernon, O.; * A. W. Judson, Surveyor and Engineer, Sandusky, O.; Josiah Kinnear, Surveyor and Engineer, Columbus, O.; J. J. Swigart, Vice President Smith Bridge Company, Toledo, O.; J. R. C. Brown, City Engineer, Ironton, O.; L. E. Gurley, with W. & L. E Gurley, Troy, N. Y.; W. F. Gurley, with W. & L. E. Gurley, Troy, N. Y.; J. S. Ellis, Civil Engineer, Perrysburg, O.; J. T. Buch, Surveyor and Civil Engineer, Cardington, O.; C. N. Brown, at O. S. U., Columbus, O.; O. H. Hoover, County Surveyor, New Philadelphia, O.; W. T. Guy, Civil Engineer, Marysville, O.; J. W. Canfield, County Surveyor, Canfield. O.; J. H. Johnson, Columbus, O.; J. N. Beemer, Columbus, O.; W. S. Fox, Surveyor and Engineer, Short Creek, O; * N. A. Sager, Civil Engineer, Toledo, O.; T. D. Paul, U. S. War Dept. Akron, O.; F. M. Davisson, Surveyor and Civil Engineer, West Manchester, O.; * C. Buxton, Chief Engineer O. C. R. R., Toledo, O.; N. H. Colwell, Surveyor and Engineer, Harden Co., Kenton, O.; Jas. E. Weight, Worthington, O.; E. D. Shreve, Mansfield, O.; Llewellyn Scarvell, Surveyor and Engineer, Zanesville, O.; * L. W. Doane, Surveyor and Engineer, Zanesville, O.; John Randabaugh, Surveyor and Civil Engineer, Celina, O.; P. Pease, Bridge Pier Contractor, Columbus, O.; L. Beckman, Manufacturer Surveyors Instruments, Toledo, O.; Saml. Bell, County Surveyor, Marion, O.; W. C. Row, Co. Surveyor, Circleville, O.; Jno. H. Holl, City Engineer, Canton, O.; Chas. A. Walker, Kirkersville, O.; John Harvey, Wilmington, O.; Jacob Greek, City Engineer, Upper Sandusky, O.; S. R. Mountain, Stenographer, Columbus, O.; Miss L. C. Rakestraw, Stenographer, Columbus, O.; Miss Daisy Beggs, Stenographer, Columbus, O.; Reuben A. Sawyer, Surveyor & Bridge Eng., Columbus, O.; G. P. Good, C. & H., C. & I. Co., Columbus, O.; Michael Fox, C. & H., C. & I. Co., Buchtel, O.; Wm. B. Hanlon, Civ. & Mining Eng., Bridgeport, O.; A. G. Pugh, Assist. City Eng., Columbus, O.; R. L. Partridge, Bridge Builder, Marysville, O.; E. C. Jones, Civil & Mining Eng., Jackson, O.; G. L. Culley, Surveyor & Eng., Cleveland, O.; M. J. Becker, Eng. P. C. & St. L. Ry., Columbus, O.; * John H. Sample, Chief Engineer, Alabama Improvement Co.; * A. R. Geyer, Engineer, Paulding, O.; * H. B. Van Atta, Assist. Eng., Hocking Valley Coal Co.; * J. Dwight Paul, Asst. Engineer, U. S. War Dept. Surveys; * J. H. Mullin, Civil Engineer, Floodwood, O.; * George Paul, Chief Eng. Chicago & Atlantic R. R. Co., and member Board of Public Works, O.; * L. A. Dickinson, Surveyor, Sandusky Co..O.; * William Ruder, Co., Surveyor, Madison Co., O.; * C. V. Martin, Civil Engineer, Zanesville, O.

At its highest stage Great Salt Lake covered about 35,000 square miles of surface, and the present body of water has barely 5000. The water is generally supposed to have disappeared by evaporation, or, in plain terms, an approximate evaporation occurred of about 116 cubic miles of water. If the lake lowered at the average rate of one-hundredth part of an inch per year (and that supposes an evaporation of 1500,000 cubic feet annually) then it was at its greatest height 1,200,000 years ago. If the evaporation continues in the future as it has in the past in 1500 years there will be nothing but a thin sheet of water during each Spring where Great Salt Lake now is.

ENGINEERING NEWS Three months for One Dollar.

SELECTED MISCELLANY.

BLASTING paper is an Austrian invention. It is merely a kind of blotting paper, coated with an explosive mixture, cut into strips, rolled into cartridge form and fired like gun-powder.

SCIENCE destroys some of the most cherished popular delusions. Catgut is derived from sheep; German silver was not invented in Germany, and it contains no silver; Cleopatra's needle was not erected by her, nor in her honor; Pompey's pillar had no historical connection with that personage; sealing wax does not contain a particle of wax; the tuberose is not a rose, but a polyanth; the strawberry is not a berry; Turkish baths did not originate in Turkey, and are not baths at all; whalebone is not bone, and contains not any of its properties.

THE average weekly receipts of some of the great lines of railway in England are: Caledonian, $273,810, with 779 miles of road in operation; Great Eastern, $343,825, with 1023 miles; Great Northern, $321,815, with 923 miles; Great Western, $656,020, with 2310 miles; London and Northwestern, $805,370, with 1774 miles; London and Southwestern, $232,725, with 708 miles; Midland, $663,755, with 1260 miles; and the London Underground, $94,850, with about 30 miles in operation. In these figures the joint receipts are not given, which would add about 20 per cent. in each case.

THERE are in existence rather more than forty Egyptian obelisks. Of these England possesses 7; America, 1; Germany, 1; France, 2; Italy (including Rome, which has 12), 17, and Constantinople, 2. The remainder, many of which are fallen or broken, are still in Egypt. The smallest is the Lepsius obelisk in the Royal Museum at Berlin, which is two feet one and a half inches high, and weighs 200 pounds; the largest, unfinished, of Assouan, still in quarries at Syene, the estimated weight of which is more than 1,500,000 pounds.

IN the twenty-eight large towns of England—containing an aggregate of 9,000,000 of population—the death rate for 1884 was 19.3 per 1,000, being 1.4 below the mean rate in the ten years ending in 1883. The rates for 1881-2-3 were 18.9, 19.6, and 19.5. The decline has been, according to the *Lancet*, coincident with the Public Health acts of 1872 and 1875. From 1840 to 1870 the rate was practically stationary at 22.4: from 1871 to 1875 it declined to 22, and in 1876-80 fell to 20.08. In the first four years of the current decade it fell to 19.3, and the death rate in each year was lower than in any of the forty-three previous years. The effect of these reductions is to add two years to the life of every male and three and a half to the life of every female born in England.

THE saltpetre beds of Nevada are far better situated for the development of their deposits than the nitre region of South America, which is a desert entirely devoid of water and all vegetable life, and where the development can be accomplished only by surmounting many difficulties; the provisions for the miners have to be transported from long distances; the water supply for all purposes is condensed from the ocean water and carried to the nitre fields, while fuel has to be procured from the mountains in the south of Chili. In Nevada, we are told, the saltpetre deposits are in the vicinity of a rich farming country, with an abundant supply of water and wood close at hand, and the nitre can be furnished at prices considerably cheaper than that for which the South American articles can be obtained.

A CALIFORNIA electrician, Professor N. S. Keith, has invented an electrical storage battery, similar in working power, but simpler in form, to that of Faure, and a company has just been formed of San Francisco capitalists for putting it into practical use. It is proposed to employ it for electric lighting, and also to run motors and street railroads. Professor Keith claims for his invention that fully 70 per cent. of the power generated can be used in moving passengers in an ordinary street-car, while with the cable systems only 32 per cent. is available. Almost no change is necessary to apply electricity to cars previously drawn by horses. One of the San Francisco systems of street-cars is about to be run by the new electric Keith motors and storage batteries.

DRY ROT.—A Russian professor has been experimenting on the best way to remove dry rot. He says that a thorough draught will destroy the parasite within twenty-four hours. If the action of draught be assisted by that of sunlight, a few hours will often suffice to put a stop to further damage. A concentrated solution of common salt is very efficacious, and the stronger it is used the more rapid its action. The action of a concentrated solution of cupric sulphate (blue stone, blue vitriol) is still more energetic and complete than that of common salt. Crude carbolic acid is rapid in its action and cheap, but inconvenient to use. But he considers that the best, cheapest, and most convenient material to employ is the tar obtained when birch wood is distilled for acetic acid; the under surfaces of the flooring are painted with the tar.

NATURAL gas in Pittsburg sells for twelve and one-half cents per 1000 feet, possible explosions thrown in.

Engineering News

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, - - - New York City.

THE ENGINEERING NEWS PUBLISHING CO. PROPRIETOR.

PUBLISHED EVERY SATURDAY.

CONDUCTED BY

GEO. H. FROST, - - - Assoc. Am. Soc. C. E.
D. McN. STAUFFER, M.Am.Soc.C.E.: M.Inst.C.E.

TERMS OF SUBSCRIPTION:

$4.00.....PER YEAR TO U. S. AND CANADA.
$5.50..... " " " FOREIGN COUNTRIES.

CLUBBING ARRANGEMENTS.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer the following terms: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00 and the following at the additional prices given:

	Net Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazaar	3.25	4.00
Harper's Young People(weekly)	1.65	2.00
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.55	3.00
North American Review	4.10	5.00

TABLE OF CONTENTS

	PAGE
Softening of Water	65
House Building in Buenos Ayres	66
Highest and Lowest Prices of Cast-iron Water Pipe; 1872-84 (*Illustrated*)	67
The Slate Fields of Pennsylvania	67
Water Blasting	67
The "Atlas" Dredge, (*Illustrated*)	68
Finding a Bore Hole (*Illustrated*)	69
Foreign Coins	69
Ohio Society of Surveyors and Civil Engineers	70
Selected Miscellany	71
Editorial Notes	72
Ohio Surveyors and Engineers	72
The R. P. I. Alumni Reception	72
Annual Meeting of American Society of Civil Engineers	72
Personal	73
Engineers' Society of Western Pennsylvania	73
Proceedings of the Engineers' Club of St. Louis	73
The Indiana County Surveyors	73
Liverpool Engineering Society	73
Boston Society of Civil Engineers	74
Travel on Brooklyn Bridge, (*Illustrated*)	74
Turnouts for Narrow Gauge Railroads	74
Correspondence	75
New York and Brooklyn Bridge Data	75
Track, (*Illustrated*)	76
History and Statistics of American Water Works	61
Water	77
News of the Week	77
Contracting	79
Recent Government Work	80
Market Report	80

CHIEF ENGINEER NEWTON, in presenting his views on the Galveston Harbor Improvement scheme, says that the present syndicate proposes to give a depth of 30 feet of water, with a special proviso that width of channel is not to be considered. In other words they can, under their proposition, give a channel 26 feet deep and 200 feet wide, with 30 feet depth in the center. Under the contract, 25 feet in depth over the bar entitles the syndicate to $6,350,000, which General Newton thinks is vastly in excess of the cost of the work necessary to produce that result. The temptation would be strong to abandon the work at that point, especially if difficulties should appear ahead, as the after compensation is comparatively small.

This project assumes such a very objectionable and outrageous shape that we regret exceedingly so honored a name as that of Capt. Eads should be in any way associated with it. While we believe that his name and South Pass Jetty fame are simply being used as a cover to the inner workings of the project, it would be well for him to assert his proper position before the public. Capt. Eads can not afford to be connected, even by inference, with the promoters of a scheme such as this.

THE U. S. Senate is apparently in no hurry to secure canal rights across the territory of Nicaragua, and on Thursday last it failed to give the two-third vote required for the acceptance of the treaty. The amendment of Senator Sherman, looking to negotiations with England and the abrogation or modification of the Clayton-Bulwer treaty, had previously been adopted as a condition precedent to the acceptance of the treaty with Nicaragua.

THE latest and about the wildest, railroad scheme proposed is a line from Quebec to Labrador. It is urged by the Canadian Pacific syndicate and has for its avowed purpose the shortening of the passage to Europe to three days only at sea. The road would be 800 miles long, and the Labrador ports are closed by ice for about four months in the year. The point of land reached would be only half as far from Liverpool as is New York.

The R. P. I. Alumni Reception.

The alumni of the Rensselaer Polytechnic Institute held their annual reception on Jan. 23, at Sieghortner's, in Lafayette Place, New York.

Jos. M. Wilson, of Wilson Bros. Philadelphia, presided, and A. P. Boller, Wm. H. Wiley and Robt. Van Buren formed the Reception Committee. After the dinner, Mr. A. P. Boller, in a short speech, introduced the President, Mr. Wilson, who then made the annual address. Mr. F. Collingwood afterwards read the treasurer's report on the condition and investment of the alumnus fund and speeches followed from Prof. Jas. Hall, N. Y. State Paleontologist, of the class of "32"; Prof. H. B. Nason, of Troy; Prof. R. H. Thurston of the Stevens Institute, and Dr. Rossiter Raymond, of the *Engineering and Mining Journal*.

About seventy Troy graduates and their guests were present; among these, in addition to those mentioned above, were:—Theo. Cooper, Consulting Eng. Van Brunt Burgen, Brooklyn Water Works; O. W. Boynton; L. L. Buck; Jos. P. Davis, Vice Prest. Metropolitan Telephone Co.; Clark Fisher, Trenton, N. J.; Alex. P. Guest; J. W. Griswold; C. A. Just; J. M. Knapp; Geo. B. and M. H. Mallory; Thos. J. Long, N. Y. Dock Dept.; David Reeves and Prof. W. H. Burr, of the Phœnix Iron Works; Prof. W. H. Searles; F. H. Saylor, Phila. Bridge Works. Prof. De Volson Wood, Stevens Institute; Wm. Metcalf, of Miller, Metcalf & Parkin, of Pittsburgh, Pa., D. McN. Stauffer, ENGINEERING NEWS, and John Bogart, Secretary Am. Soc. C. E.

Annual Meeting, American Society of Civil Engineers.

PROCEEDINGS OF THURSDAY, JAN. 22.

We continue our report of the Annual Meeting of the American Society of Civil Engineers from our last issue.

On Thursday morning, according to the programme announced, the Society first accepted the invitation of the Consolidated Gas Company to visit their very extensive works at the foot of East 21st street, New York, the invitation being tendered through the courtesy of Mr. T. F. Rowland, member of the Society.

A new and most commendable feature in the visits made to points of interest at this Convention, was the preparation and previous distribution, by the Secretary of the Society, of detailed illustrations and printed descriptions of the various points to be examined during the day. The result was, a very much increased interest, a more comprehensive and thorough appreciation of the novelties encountered, an opportunity for carrying away exact information and the avoidance of the usual unsatisfactory verbal description rarely heard outside of a very narrow circle.

At the New York Station of the Company examined, the entire process of producing illuminating gas by the decomposition of water was seen in operation and fully described by Mr. Rowland and the officers of the works. For the benefit of those members not present and our readers generally we give a brief description of the method here followed. In this case, a plan was distributed showing a hypothetical plant, from the boilers running the machinery and furnishing the steam required, to the gas-storage tank. This scheme of gas-making involves the decomposition of water, with the resultant of hydrogen and carbonic oxide; the enriching of this product with naptha vapor, and the final formation of an illuminating gas of high candle power.

In order of plant, the "gasogenes" are the first in importance; these are iron shells, lined with firebrick, and forming a furnace-chamber in which a body of coal is ignited and brought to a high state of incandescence by an air-blast. When the proper temperature is reached in the gasogene, the air blast is shut off and the waste-product valve closed; steam is then admitted and directed into the lower portion of the glowing coals, and, in passing up through the mass, is decomposed; the oxygen is combined with its equivalent of carbon, thereby forming carbonic oxide, and the hydrogen is liberated and intermingled with it. This product passes out of the gasogene, through a pipe containing a water-seal, and enters the hydrogen holder.

From this last the crude gas enters the "Carbureters." These consist of iron trays, placed one on the other, and having openings to allow the gas to circulate through them. These trays are enclosed in water jackets and contain the naptha, to be vaporized; this last operation is effected by heating the surrounding water by a steam jet. As the gas passes through the carbureters, it is mingled with the naptha vapors, and thus mixed goes to the "benches." These benches are fire-clay retorts, set in brickwork, and closed at both ends by sealed doors; pipes at either end of the retorts pass the crude gas in and carry it away to the next stage in the process. The effect of the passage of the gas through these retorts, which, by the way, are heated to a bright red by a fire common to all, is to roast it or to thoroughly combine the naptha vapor and the crude gas into a fixed gas; without this fixing process the product would soon loose the naptha component.

Next, the gas enters the "condensers," which are a series of vertical tubes surrounded by running water. Here the gas is cooled and the watery vapors and heavy oils are condensed and precipitated into the lower portion of the condenser and carried off by waste pipes. The "scrubber" then washes the gas and cleans it of napthaline and such other impurities as would not be taken out by the "purifier." The scrubber is an iron shell containing a nest of wooden trays (open slat style) through which the gas passes, subject to a spray of water coming from the top.

The "exhauster," by a slight vacuum, draws the fixed gas from the "benches" and forces it through the remaining portion of the way to the storage tank.

The "purifier," which comes next, removes the carbonic acid and sulpher from the gas. It consists of large iron boxes with removable covers, generally arranged in sets of four, each connected by pipes to a center seal which is common to all. Each box contains a series of slat-trays in layers, and on each layer of trays lies a bed of air-slacked lime about one foot thick; through this lime the gas percolates, the carbonic acid and sulphur unite with the lime and remain behind, and the gas, ready for use, passes to the holder.

This is the process in brief, and it only remains for us to testify to the courtesy with which the visitors were received and the admirable arrangements of the plant examined.

Embarking on a steamer at the works, for the use of which the Society was again indebted to Mr. Thos. F. Rowland, the entire party proceeded down the East River to the

Dow's stores, at the foot of Pacific Street, Brooklyn. Here, the party were taken in charge by Mr. Geo. B. Mallory, who designed and superintended the construction of these grain elevators. The storage capacity for grain is 2,500,000 bushels; the elevating capacity is 60,000 bushels per hour. Any description of so complicated a structure as a grain elevator, with its machinery, would be very unsatisfactory without the aid of elaborate plans, hence, we will only say that all parts of this particular plant were examined by the visitors with great interest. The especial feature here was the excellent and efficient arrangement for the transmission of power by steel wire ropes.

Returning to New York, about "13 o'clock," the party next called a halt at the Washington Building, No. 1, Broadway, where they enjoyed the hospitality of the owner, Cyrus W. Field, Esq., in the shape of a bountiful and handsomely served lunch. Mr. Field personally welcomed his guests, and the Society, through President Graff, acknowledged the courtesy extended. The presence among the invited guests, at this point, of a "distinguished engineer from the Island of Hayti," in a uniform resplendent with gold lace, at first disturbed and then called forth profuse attentions from some of the attendents on the lunch room. Members of the Society will, perhaps, better recognize the modest recipient of the honors paid under his Christian name of "William," a most useful and important adjunct to the Annual Meetings and Conventions of some years past.

The Produce Exchange was the next point of interest in the programme; and to it the party proceeded under the escort of Mr. Geo. B. Post, the architect of this truly remarkable building, and Mr. Thomas E. Brown, under whose direction the extensive elevator plant was erected. The officers of the Exchange greeted the Society, and gave the visitors a short sketch of the methods by which this community within itself was governed. Mr. Post then explained the points about the construction most likely to interest the engineers, and said enough to convince his hearers that a very high grade of engineering skill was requisite in the erection of a building such as this. The Society then inspected the building from the boilers, pumps and dynamos in the basement to the top of the 200 feet tower.

The party next landed at the foot of the New York tower of the Brooklyn Bridge; walked to the Chatham Street entrance; crossed over the bridge in the cars to the Brooklyn end and there inspected the cable machinery and the electric light plant.

The members were provided with various diagrams and printed data to further illustrate this part of the programme. One of these diagrams, which we illustrate in this issue, graphically displays the variation of travel over the bridge during the several hours of the day. Another diagram, prepared by Col. Wm. H. Paine, showed the varying power expended in hauling the bridge trains; the variation being due both to the ever changing loads to be carried and the crowning grades on the bridge. This diagram, while important and interesting, is rather too complicated either for illustration or verbal description at present. The New York and Brooklyn Bridge data, printed elsewhere, while containing some old figures, has in it sufficient new matter to warrant its publication.

The excursions of the day were ended by a visit to the Central station of the United States Electric Illuminating Co., at 36 Stanton St., where the very extensive plant of this company was seen in full operation.

On Thursday evening the usual reception was held at the Society House for members and their guests. This reception was largely attended, and was a repetition of former joyous occasions. Remarks were made by Horatio Allen, Esq., on the early railway era of this country with which the speaker was so prominently identified; and the Secretary of the Society read the versified regrets of, perhaps, the oldest living American engineer, Squire Whipple, Honorary Member of the Society, as follows:

To the Committee of Arrangements for the Annual Meeting of the Am. Soc. C. E.

ALBANY, Jan. 21, 1885.

Dear Bogart, Collingwood and Stauffer:
What's life, but *be*, and *do*, and suffer?
And what avail the other two
To one ayent the power to do?
I've doffed the armor, left the field,
With all the triumphs it may yield
To those a half a cent'ry younger
Who still for fame and fortune hunger:
With cleverer brain and stronger muscle,
'Gainst obstacles to tug and tussle.
I've had my day, nor wish another,
With meagre fun, and muckle pother.
Still, doubt you not a single minute,
There's glory yet for those who win it.
Grade up your valleys, pierce your mountains
Sink your mines and dam your fountains;
Cut down your hills and bridge your rivers
With cables, trusses, cantilevers.
Let nothing daunt, let nothing stagger ye
From Tehuantipec to old Niagara
Let every town have wholesome water
And chloroform the beasts they slaughter.
If Ocean bars arise to fret ye
Bold Eads can move them with a jettie;
Or wed Atlantic to Pacific
With iron bands quite scientific.
And, when you need electric medicine,
Just call on Bell, or Brush, or Edison.
Each knows full well which end his head is on.
But, if 'you've news' across seas to wire us,
You'd better leave the Field to Cyrus,
And, when we think of deeds ennobling,
Who'd ere forget the name of Roebling?
But rhyming's not my avocation.
And but for this unique occasion
I never should have once attempted
To pump a brain so quickly emptied;
And, if the folly you'll excuse
Of this attempt to court the muse,
You may depend that old S. W.
No more will *thus* presume to trouble you.

237 State Street.

PERSONAL.

MR. M. BURLOE, now Superintendent of the Miss. & Tenn. R. R. has been appointed General Superintendent of the Louisville, N. O. & Texas R. R.

O. J. TRAVIS, ex-Master of Bridges on the Wabash and formerly Superintendent of the St. Louis Bridge, has accepted the position of Master of Bridges on the Union Pacific.

E. L. TYLER of Anniston, Ala., who has been permanently connected with the Anniston and Atlantic R. R. and the Anniston Car Co., has been appointed Superintendent of the New Orleans and North Eastern R. R., with residence at New Orleans.

PUTNAM SPALDING, U. S. Coast Survey, Memphis, Tenn., was married on Jan. 22, to Miss Annie Packer Wilbur, daughter of Warren W. Wilbur, of Bethlehem, Pa., and niece of President Wilbur, of the Lehigh Valley R. R. Company.

Engineers' Society of Western Pennsylvania.

The Engineers' Society of Western Pennsylvania held its annual and regular meeting and election on Jan. 20. The retiring president, William Miller, and other officers presented their reports. The society at present has a membership of 299, an increase of 52 during the year.

The question, "Does the admixture of steam with natural gas prevent the gas from depositing coke in the furnace?" was discussed. Mr. Walter Jarboe thought that a certain substance always remained in the furnace, which he thought was coke or oxide of iron.

To the question: "In the case of wells which have yielded both gas and oil, does the flow of gas continue after the supply of oil has ceased?" Mr. Jarboe replied that he did not know of a single well which has been a gas well from which oil flows, but he had seen one of the kind some years ago. He said instances like the one in question were very rare.

Colonel Roberts read a paper which expressed similar views.

Mr. Max. J. Becker read a very instructive paper on "Breaking of Rail Joints and Splice Bars."

G. H. Brown was elected President; C. L. Strobel, Vice President; A. E. Frost, Treasurer; W. F. Zimmerman, Secretary, and William Martin and William Thaw, Jr., Directors.

Proceedings of the Engineers' Club of St. Louis.

ST. LOUIS, January 21, 1885.

The Club was called to order at 8.15 P. M. at the Mercantile Club Rooms. President Robert Moore in the chair, twenty-four mmebers being present.

The reading of the minutes of last meeting was dispensed with. The President reported a letter from the Librarian of Mercantile Library in regard to Scientific Works.

The following gentlemen were proposed for membership: Messrs. F. B. Malthy, by J. A. Ockerson and J. B. Johnson; A. J. Svpher, by W. E. Potter and E. A. Engler; John G. Kelly by Ed. Flad and G. Bagnal.

Mr. W. Bouton then read a paper on "Elimination of Errors in Field Work," which was discussed by Messrs. Johnson, Holman and Constable.

Mr. Howard Constable then read a paper on "Water Meters," exhibiting a variety of meters. This paper was generally discussed.

Mr. Melcher exhibited a copy of "Steam Making" by the late Prof. Chas. A. Smith, which has just been published.

Adjourned.

THOS. D. MILLER, *Secretary.*

The Indiana County Surveyors.

The State Association of county surveyors met last week in Indianapolis and papers were read by L. S. Alter, of Jasper county, on "Drainage," and by S. H. Wells, of Putnam, on "Duties of Surveyors." Other matters of professional interest only were considered. The association next adjourned after electing the following officers: President, R. Spencer, of Rush county; vice-president, William M. Whelton, of St. Joseph county; recording secretary, W. S. Fries, of Hancock; corresponding secretary, L. S. Alter, of Jasper; executive committee, R. H. Wells, of Putnam, H. B. Fatout, of Marion. J. W. Craig, of Decatur, W. A. Osmer, of Cass, James M. Waugh, of Tipton; legislative committee, A. H. Poke, of Gibson, R. H. Walls, of Putnam, Jehu VanBuskirk, of Kosciusko, R. R. Spencer, of Rush; printing committee, W. S. Fries, H. B. Fatout, and R. M. Morrison, of Henry.

Liverpool Engineering Society.

At a recent meeting of this Society, held at the Royal Institution, Colquitt street, a paper was read by Mr. Ludwig Benjamin, M. I. N. A., on "The different rules in use for ship's calculations." The author pointed out the necessity of paying attention to the elements of naval architecture at the present time, since the amount of calculations has increased considerably. He showed how large errors may be caused by indiscreet application of the different rules, and gave as a forcible example the present tonnage rules, the unfittedness of which he pointed out. He discussed the elements in a novel manner, explaining the different rules, by comprehensible diagrams, in substitution of the elaborate and highly mathematical explanations generally given. By means of these explanations he showed which points of importance ought to be borne in

mind by the calculator, and drew attention to several details where the general practice might be improved.

Boston Society of Civil Engineers.

A meeting of the Boston Society of Civil Engineer was held on Wednesday evening Jan. 21st. Vice President F. L. Rice in the chair, 31 members and 3 visitors present, A. M. Tidd and Arthur H. Howland were elected members of the society. A paper was read by Mr. H. A. Carson on the "cross sections of sewers and conduits." The reading of the paper was followed by a discussion of the subject by Messrs. Clarke, Philbrick, Stearns, Carson and others.

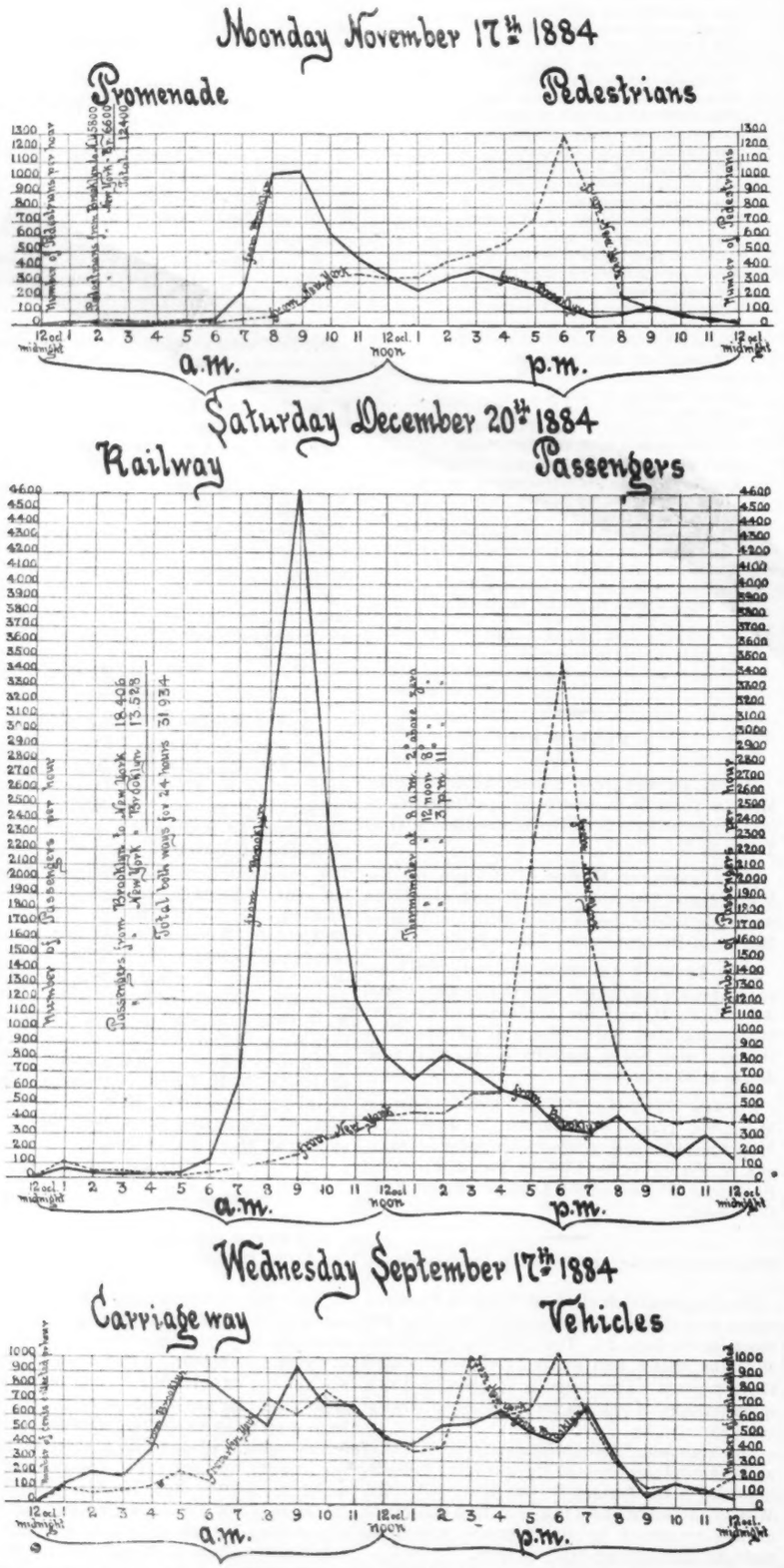


DIAGRAM SHOWING TRAVEL UPON NEW YORK AND BROOKLYN BRIDGE

(SEE PAGE 72.)

Turnouts for Narrow Gauge Railroads.

Instructions for Putting in Frogs and Switches.

BY EMILE LOW, C. E.

Although there are not now as many narrow gauge railroads built as in former years when the narrow gauge fever was at its height, yet the total number of miles of the same forms no inconsiderable portion of the total railroad mileage.

Of course narrow gauge railroads will continue to be built in the future as in the past and it is to those interested in that system that I offer the following suggestions in regard to putting in frogs and switches or turnouts as they are now more propererly called. It may be well to state here that under narrow gauge I refer to the gauge of three feet which is considered the *standard* narrow gauge.

During my connection some years ago with one of the most prominent narrow gauge railroads in the State of Pennsylvania, I had occasion to issue for the guidance of masters, track-foremen and others interested, in main the instructions given below which I have now modified slightly to suit the exigencies and demands of more improved manners and methods. In these instructions mention is made of stub as well as of split switches. I know there are well founded objections to the use of the former kind, which objections I do not desire to recall here, they being foreign to the subject in hand.

I can safely assert that a greater number of this kind of switch is in use on narrow gauge railroads, and, as its first cost is less than the split switch, the steel stub switch will undoubtedly continue to be much used in the construction of narrow gauge railroads where question of first cost always take precedence and are oftentimes of paramount importance. But should any company at any future time feel disposed to replace these steel stub switches with split switches it can easily be done without inconvenience, all that is necessary is the changing of the switch stand from the *toe* of the switch to the *heel* of the same and the insertion of the split switch rails, the frog remaining in its original position.

The throw of the switch rails I have taken at four and one-half inches, which I found worked very well in practice.

The number of different kinds of frogs needed for various service I have placed at four, namely, the No 6, the No. 7, the No. 8½ and the No. 10. These I think will answer every purpose and will be found to fulfill all and every requirement likely to arise.

I would not advise the use of a smaller frog than No. 7 for the reason that a smaller number requires a very sharp curve in the turnout making it difficult for engines with a long wheel base to go around them readily The No. 7, frog requires a curve of 294.0 feet radius corresponding to a curvature of 19°35'.

I know of instances where No. 5 frogs were used in the construction of a "Y" where ground was expensive to obtain and the smallest possible quantity had to be considered sufficient. The radius of the turnout curve for a No. 5 frog is 150.0 feet.

Nor is it advisable to use a higher number than 10, for then we obtain a very long switch rail which must be left unspiked. Although connected at suitable intervals with bridles long switch rails, especially where light rail is used, are apt to prove dangerous. The following are the instructions referred to above:

Instructions for putting in frogs and switches.—In order to insure a system of uniformity in putting in frogs and switches and that foremen may act understandingly in regard to the same the following instructions are given:

In sidings, either to the right or to the left from the main track, either the No. 7, the No. 8½ or the No. 10 frog will be used as cumstances may require or as may be ordered.

Frog Distances for Stub Switches.—When the No. 7 frog is used, the distance from the head chair at the switch stand to the point of the frog, measured along the main line rail, will be 27.2 feet; for the No. 8½ frog, this distance will be 33.0 feet and for the No. 10 frog, 38.8 feet.

The switch or moving rails to consist of two 30 feet rails, to be spiked within 14.8 feet of the head chair for the No. 7 frog; 18.0 feet for the No. 8½ frog and 21.2 feet for the No. 10 frog.

These rails to be held in position by 4, 5 and 6 bridles respectively for the No. 7, No, 8½ and No. 10 frogs. Each of these bridles to be confined between two ties spaced four inches apart between edges.

Frog Distances for Split Switches.—Where split switches are used the distance from the switch stand (placed at heel of the switch) to the point of the frog, measured as before along the main line rail, will be 42.0 feet for No. 7; 51.0 feet for the No. 8½; and 60.0 feet for the No. 10 frog. These distances must in all cases be absolutely regarded, no variation whatever to be permitted in this respect.

Double Switches.—In putting in a double switch (one when two sidings leave the main track at the same point one going to the right and the other to the left) in one case the No. 8½ frog will be used for the crossing of the rails of the main track and the No. 6 frog for the switch

frog at the crossing of the two lead rails in the center of the track.

The distance of the points of the No. 8¼ frogs from the head chairs will be the same as given above for stub switches, namely 33.0 feet, while the point of the No. 6 or crotch frog will be placed 18.1 feet from a point at right angles with the head chairs and measured on a parallel line with the main track.

In the other case the No. 10 frog will be used for the main line rails crossing and the No. 7 frog for the crotch frog.

The frog distance for the No. 10 frogs will be the same as for the single turnout, namely 38.8 feet, and the frog distance of the crotch frog 21.2 feet, being the distance between the frog point and the head chairs.

Cross-Overs.—For cross overs from one track to the other the No. 8¼ frogs will be used. The distances between the head chairs where stub switches are used will be 99.7 feet and with split switches this distance will be 135.7 feet, measured on a line parallel with the center of the tracks.

The frog distances at each end being the same as given above for this Number of frog, namely 33.0 feet for the stub switches and 51.0 feet for the split switches.

This will leave the two frogs 33.7 feet apart measured in a line parallel with the main line rails.

Switch Ties.—The switch ties to be of white oak or other suitable timber sawed on two parallel faces, exactly six inches thick and not less than eight inches wide on the face.

They will be spaced twenty-one inches center to center and will be placed in the order of the numbers as for the bill of switch timbers for each particular switch The ends of the ties to be evenly lined up on each side of the outside rails and to project 18 inches beyond the inside or running side of the rail.

Guard Rails.—The guard rails to be fifteen feet long (a whole rail being cut into in the middle for this purpose) with the middle placed directly opposite the point of the frog and leaving a distance of two inches between edges of rail heads. The guard rails to be securely spiked with three spikes to each tie. The end of the rails also to be uniformly bent slightly outwards towards the center of the track so as not to offer any obstructions to the safe passage of wheels.

Chairs.—The head chairs of stub switches to be arranged so as to give one-half inch space between the ends of fixed and moving rails.

The head chairs, leads and frogs to be put in perfect line and surface.

Extra care shall be taken to have the switch ties evenly surfaced and thoroughly tamped and especially those upon which frogs and head chairs rest.

The distance between the center of the main track and the center of the siding to be 10 feet, or 7 feet between the inside or running side of nearest rails.

When practicable the switch stands to be placed on the same side of the main track as that of the siding.

Switch signals will be arranged so as to show white when the switch is set for the main track, and red when set for the siding.

Safety ports to be put in between the two tracks at such points where there is a full clearance of 7 feet.

Full and explicit directions for putting in frogs and switches correctly are now given and the attention of foremen is asked to a full observance of the same.

CORRESPONDENCE.

Relief Maps.

Special Correspondence Engineering News.

WILMINGTON, DEL., Jan. 26th, 1884

EDITOR ENGINEERING NEWS:—The article in the NEWS of Jan. 24th on the Manufacture of Relievo Maps has suggested to the writer that a brief description of the construction by him of a relief map of the State of New Hampshire for Dr. C. H. Hitchcock, State Geologist, during 1875-6 might be of interest.

The completed map was about sixteen feet long, and the greatest elevation, about six and one-half inches above the plane representing sea level.

The topography of the State having been very thoroughly worked up under the doctor's direction, a new map was published about six feet long, on which contour lines were shown for each fifty feet elevation above sea level.

It was determined to construct the relief map two and one-half times the size of the printed one.

By means of a pantograph the contour lines were drawn on tracing cloth from those on the printed map to the scale of the proposed model.

The material used was bass wood, one-half inch thick, the vertical scale being 1" = 100 ft.

From the enlarged topographical map on the tracing cloth the sea level line and first fifty feet contour were traced on a layer of wood by means of an ivory stylus or stilleto pressed hard on the cloth placed on the wood. This gave two distinct lines on the surface, which were then gone over with colored pencils, blue for outside and red for inside. The outer line was followed around with a fret saw, thus detaching the wood outside of sea level line.

This layer of wood was then fastened down to a pedestal on which the map was to rest by means of brads and glue.

The next layer was then traced and marked as in case of first, but the outside line in this case was the first fifty feet contour and the inside or red line, the next above This having been sawn out on blue line, it was placed in position on the first layer, the red lines on this being a guide by which to locate and also to check the outlines of the second layer. This process was followed throughout the thirteen layers necessary to attain the elevation of Mt. Washington.

When three layers were firmly in place the steps in their edges were cut off with chisels and gouges to present smooth slopes, the red contours being the guiding lines, thus, when completed, the side slopes of the elevated parts had the exact angles proper to the scales used.

The finish consisted in going over with sand paper and painting a neutral tint, after which the water courses, railroads, towns, and county lines were located, and all, including mountains, plainly lettered and over all a coat of varnish to protect the surface.

Previous to putting on of the details moulds were made from the map, and subsequently several copies were cast in plaster for use of academies and schools throughout the State.

A number of relief maps have since been made of other parts of the country by similar processes, but no printed description has come to writer's notice of a method as economical and satisfactory as that outlined above.

Yours truly,
MACE MOULTON.

Creeping of Rails.

WAY CROSS, GA., January 19, 1885.

EDITOR ENGINEERING NEWS:—Having noted carefully the article on the creeping of rails on the St. Louis bridge, in ENGINEERING NEWS for January 10th, also the inquiry of H. C. K. in a subsequent issue, I take the liberty of offering a suggestion.

The phenomena of the movement of rails in track are so variable that several hypotheses will undoubtedly be required to explain them all. I think that Prof. Johnson has shown very clearly one of the causes for the creeping of rails, viz., a wave motion causing an extension of the lower fibres and a consequent creeping or rolling action. I will not undertake to consider these phenomena in detail, but will simply explain an expedient which has been resorted to on the Savannah, Florida & Western Railway for preventing the creeping of rails, and which has been eminently successful. At one point we have a trestle about one half mile in length, on this trestle there is laid a 50-pound steel rail connected with outside and inside angle plates slotted and spiked to the ties. At times, particularly during the warm weather, the creeping movement of the track was such that spikes and bolts were sheared off or torn out and angle plates torn asunder. On three occasions immediately after the passage of heavy freight trains, joints were found open 7, 12 and 18 inches respectively. To remedy this angle plates were bolted on each side of every rail *at the center* and spiked in the slots, enough space being allowed at joints for expansion. Thus each rail is held independent of the adjacent rails and the movement produced in it, either by pressure of wheels or by change in temperature, affects only itself. For two years there has been no continuous movement of rails at this point. At other points on our line, where trouble was usually experienced in hot weather by the combined action of creeping and expansion, and where ties were driven several feet out of position, in the adoption of this and other simple devices we have found a complete remedy.

I remain, very respectfully,
H. W. REED.

Fairfield Iowa Water-works.

——— VALLEY, Jan. 28, 1885.

EDITOR ENGINEERING NEWS.—I beg leave to correct a little error that has crept into the Fairfield, Ia., Water-works Statistics.

The plans for *reservoir dams* and *distribution system* were substantially furnished by Mr. C. B. Davis, while the plans for *pump house, standpipe and pumping machinery* were those of Geo. B. Inman, Contractor.

The total length of the pipe system including main and distribution is a little over 4½ miles instead of 45 miles as stated.

Yours respectfully,
W. KIERSTED, JR.
Const. Engr. Fairfield Water-works

Creeping of Rails.

GALVESTON, TEXAS, Jan. 20, 1885.

EDITOR ENGINEERING NEWS:—I read in your paper of the 3d inst. Mr. J. B. Johnson's theory of wave motions, causing the rails of the St. Louis bridge to creep. From observations there and elsewhere I think his theory correct. But is it not also very probable that these wave motions produce a violent vibration of the rails ahead of a moving train? Which vibration is nearly deadened a very short distance ahead of the train except on a rigid roadbed similar to that on the St. Louis bridge? And would it not be probable that some kind of cushion under the rails or their supports would obviate in a great measure, the trouble?

Yours respectfully,
"M."

Simplifying Land Surveys.

GLENWOOD, MINN., Jan. 21, 1885.

EDITOR ENGINEERING NEWS: Have there been any laws passed by State Legislatures, for improving or simplifying the system of land surveying during the past five years, if so, when and where?

Respectfully yours,
R. J. KINNEY, C. E.

[We do not know of any; perhaps some of our readers do, and if so we will be pleased to hear from them.—ED. ENG. NEWS.]

New York and Brooklyn Bridge Data.

	FEET
Size of New York caisson	172×102
" Brooklyn "	168×102
Depth of tower foundations below high water, New York	78
Depth of tower foundations below high water, Brooklyn	45
Size of towers at high-water line	140×59
" " roof course	136×53
Total height of towers above high water	272
New York tower contains 46 945 c. yds. masonry.	
Brooklyn tower, 38 214 c. yds. masonry.	
Size of anchorages at base	129×119
" " at top	117×104
Height at top	89
Length of main span	1 595½
" each land span	930
" Brooklyn approach	971
" New York approach	1 562½
Total length of bridge	5 989
Clear height of bridge at centre of main span above high water	135
Clear height of bridge at centre of main span above Chatham street (on roadway)	100
Width of bridge	85
Grade of roadway	3½ feet in 100
Number of cables	4
Length of each cable	3 572
Diameter of each cable	15⅞ ins.
Weight of main span	6 740 tons.
Total weight of superstructure	14 680 "
Extreme movement of slip-joint of main span	12⅞ ins.
Extreme variation in elevation of the centre of the main span	30 ins.

The bridge is lighted by 82 electric lights, of 2000 candle power each, in two circuits.

The electricity is generated by four 20-light dynamos, driven by two 50-horse power Corliss engines.

This plant was furnished, erected and put in running order by the United States Illuminating Company.

Cable Railway Plant.

One steel wire cable, 1⅞ inch diameter, 11 450 feet long, weighing 3½ pounds per foot=40 075 pounds.

Two main driving drums, each 12 feet in diameter.

One intermediate friction drum, 5 feet in diameter.

One spur wheel, 12 feet in diameter.

One spur wheel, 5 feet in diameter.

Two guide sheaves, 10 feet in diameter, one on each balance car.

Seven guide sheaves, 10 feet in diameter, for changing the direction of the cable at various points.

Two packed sheaves, 10 feet in diameter, for driving auxiliary machinery.

MOTIVE POWER.

Two horizontal steam engines, with cylinders 26×48 inches. Each engine has a fly-wheel, and is capable of acting singly or in conjunction with the other. These engines and the machinery were made by the Dickson Manufacturing Company, of Scranton, Pa.

Four Babcock & Wilcox water tube boilers, 104-horse power each. These also furnish steam for two 50-horse power engines, which drive the dynamos for lighting the bridge; also for one 20-horse power engine in the machine shop, besides the steam required for heating the shops and offices.

One Baraguanath heater, 40×136 inches

One Knowles pump, cylinders 10 and 6 inches, stroke 12 inches.

One Hancock inspirator.

Engine, speed 57 revolutions per minute.

Speed of cable, 880 feet per minute, or 10 miles per hour.

Engine duty required to run the machinery and cable without cars, 35-horse power.

Average coal consumption for car service, 20 hours, 6 tons.

ROLLING STOCK.

The rolling stock consists of—

Two switching locomotives of 9 tons each, built by H. K. Porter & Co.

One switching locomotive of 13 tons, and one of 14 tons, built by the Baldwin Locomotive Company.

Twelve passenger cars 48 feet long, and twelve 36 feet long, built by Messrs. Bowers, Dure & Co.

Six passenger cars, 49 feet long, built by Pullman Palace Car Company.

Weight of cars, each 10 tons.

Weight of cars with maximum load, 20 tons.

Present number of cars in each train, 2.

Maximum number of cars running at one time, 20

Maximum number of car trips in one day 20 hours, 1 200.

Maximum number of passenger transported in one day, 40 000.

Total number transported from September 24th, 1883, to January 1st, 1885, 10 510 940.

Total number of foot passengers from May 24th, 1883, to Janury 1st, 1885, 8 403 300.

Total number of vehicles, 992 200.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from page 60.*)

The bolts used are generally ⅞ inches in diameter and 3¼ or 3½ inches in length, according to the thickness of the rail and plate combined and whether a nut lock is to be added. The bolt holes in the rail are drilled 1 inch in diameter in order to allow expansion room, while to prevent the bolt from turning, when the nut is tightened, the hole in the plate is punched oval to fit the enlargement of the bolt as shown in Fig. 45. The nuts are made either

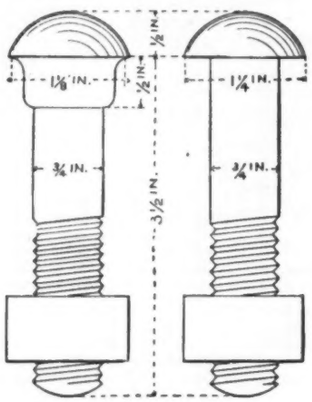


FIG. 45—RAILROAD BOLT.

square or hexagonal, the choice, unless governed by form necessary to fit the splice, is a matter of preference. We now come to the all important topic of loose bolts and their remedy. Any nut under constant vibration will work loose. If the thread is very carefully and accurately cut, as in fine machine bolts, this tendency is very considerably reduced, but with track bolts, where cheapness is insisted, and consequently the cutting of the thread slighted, the fit between bolt and nut becomes imperfect, and the rapidity with which

FIG. 46—VERONA NUT LOCK.

a nut will back off seriously increased. Now it is *absolutely necessary* for good track that the bolts should be kept tight, if not, the plates are not held fimly in place, their strength materially and rapidly diminished, and the joint not only becomes low, but, if allowed to stay so, worse still, the ends of the rails are permanently bent. Therefore tight bolts must be insisted on. The question of remedy is one that long since has received the attention of inventors, the number of patents taken out being many of more or less utility, principally the latter. The requirements for a good nut lock are as follows:

First, absolute simplicity. Second, durability and permanence. To comply with the first the parts must be few, readily adjusted and taken apart, and without any complexity whatever. When it is considered that a foreman on a double track section of four miles has nearly 12,000 bolts to look after, the force of these remarks is appreciated. Any form of nut lock which requires special tools, or is in several parts, and needs adjusting or care in putting in place, it is highly probable that on account of the very large number of bolts to be attended to, many of them will be neglected, especially in the hands of non-mechanical labor. The second requirement means that the locks shall be strong, capable of receiving rough handling and of being subjected to heavy strains, and especially be permanent and not affected by the weather.

The different forms can be divided into three classes, according to the principles upon which they depend.

First, springs; second, elastic substances; third, miscellaneous.

The best representative of the first is the Verona nut lock, Fig. 46, which is in more general use than any other lock, and depends for

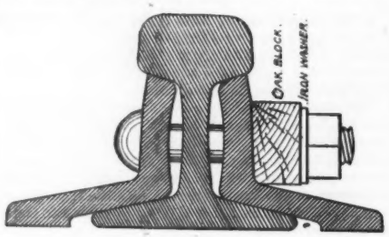


FIG. 47—WOOD NUT LOCK.

its efficiency on the elasticity of the iron itself to provide a spring between the nut and the splice bar. It is an excellent lock but not infallible. There are a large number of devices constructed on this principal, being mostly, however, more complicated and inferior to the simple Verona. Some the of variations, made in steel, have sharp points, or studs, which are expected to be driven into the softer iron of the bar and nut. The second class depends on a solid cushion between the nut and plate. Of these the simplest, and of course unpatented, is a block of hard wood which is put on the outside of the joint as shown in Fig. 47, and the nuts are screwed down tight against

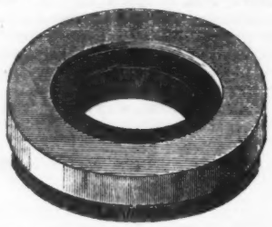


FIG. 48—VULCANIZED FIBRE NUT LOCK.

an iron washer, between it and the wood, this giving an elastic cushion to take up the vibrations. Its size is entirely arbitrary, from 1 to 2 inches in thickness, and long enough to carry all four bolts, or else be in two smaller pieces, one for each pair. Although this works satisfactorily when new, yet it is objectionable on several accounts. First, the wood softens and decays, and soon the bolts must be retightened, an operation which has to be repeated from time to time for about two years, when the value of the block is gone. Second, it is unsightly.

The vulcanized fibre washer Fig. 48, is another widely used and effective lock, but like the wood proves a victim to decay and hardens by exposure, while it is sometimes crushed under pressure. To obviate this latter, and give better protection against the weather, the iron clad form has been invented with a metal cap as shown in the diagram. The third or miscellaneous group embraces many forms, among which are found many good styles of jam nuts, but which are too complicated for track use, as can be said of the large number of devices with wires, wedges, and locking

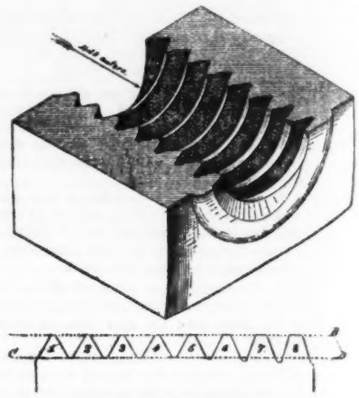


FIG. 49—HARVEY NUT LOCK.

plates. The most notable example of group No. 3, however, is the "Harvey," which best answers the requirements of a perfect lock. The principle is shown in Fig. 49, a slightly varying thread in the nut which, by the act of setting up, is cut into an absolutely tight fit by the thread of the bolt. In point of life it will last as long as the bolt, and is quite as durable as any of the other forms. Its great merits lie in its efficacy and entire simplicity, since the whole is contained in the nut and bolt without any additional parts. It is impossible for a trackman to lose or misplace it. When the bolt is in and the nut set up the lock is there too.

(TO BE CONTINUED.)

*Copyright by ENGINEERING NEWS PUBLISHING CO. All Rights Reserved. This article was commenced on October 4 1884.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E.

Continued from page 61.

DCCXIII. FAIRPLAY, COLO.

Fairplay, Colorado, in lat. 39° 30 N., long. 105° 30 W. the county seat of Park County, is at the head of South Park, 9,764 feet above the sea.

Water-works were built by the town in 1883 taking the supply from springs, from which the water is conveyed by an open ditch 3 feet wide, and 15 inches deep and ¾ of a mile long, to a reservoir constructed in excavation 50 by 150 feet at the bottom and 90 by 220 feet at the top, and being 78 feet above and 2500 feet distant from the centre of the town.

Distribution is by 1.6 miles of lap-welded wrought-iron pipe, with 14 fire-hydrants and 28 taps.

Service pipes are of galvanized and black iron.

The daily consumption is not known.

The works have cost $11,000. The bonded debt is $10,000 at 8 per cent. The yearly expenses have been $600, and the receipts $500.

The population in 1880 was 450.

A. E. Jones is Treasurer of the town.

DCCXIV. FORT SCOTT, KAN.

Fort Scott, Kansas, in lat. 37° 50′ N., long. 94° 45′ W., the county seat of Bourbon County is on the Marmaton River, in a district rich with coal, hydraulic cement and mineral paints. It was established as a military post in 1842 and was incorporated a town in 1855.

Water-works were built in 1882 by a private company.

The supply is taken from the Marmaton River and is thence pumped by a Perkins Steam Pump to a reservoir whence it is dis-

tributed by 8 miles of cast-iron pipe, with 55 fire-hydrants, 10 meters and 428 taps. The town pays $60 yearly for each hydrant.

The daily consumption is 300,000 gallons. Service pipes are of wrought-iron.

The works have cost $90,000. The bonded debt is $50,000 at 6 per cent. The yearly expenses of maintenance are $2,600 and the receipts $6,000.

The population in 1880 was 5,372.

B. F. Gardner is the superintendent.

DCCXV. FRANKLIN, MASS.

Franklin, Norfolk Co., Massachusetts, is in lat. 42° 3′ N., long. 71° 25′ W. It was incorporated a town in 1778. Water-works were built in 1884 by a private company, after plans and under the superintendence of F. E. Smith, C. E., the supply being taken from a well. The water is pumped by a Knowles compound duplex condensing pump, of 18 and 10 in. steam and 14 in. water cylinders and 10 in. stroke, having a daily capacity of 1,000,000 gallons, to an iron tank 40 feet in diameter and 35 feet high, holding 330,000 gallons.

Distribution is by 5½ miles of sheet iron and cement pipe of 12 to 4 in. diameter, with 50 fire-hydrants, for each of which the town pays $48 annually. Service pipes are of iron. The capital stock of the company is $75,000. The population in 1880 was 4,051. No further information is given.

DCCXVI. FREEPORT, PA.

Freeport, Armstrong Co., Pennsylvania, in lat. 40° 40′ N., long. 79° 40′ W., is on the Alleghany River.

Water-works, were built in 1883-4, by a private company, taking the supply from the Alleghany River. A timber crib 7 feet square and 7 feet in height, covered with two inch plank crossed with inch boards, is sunk in the gravel bed of the river, and covered with 18 inches of gravel, the water entering from the bottom and furnishing at all times an abundant supply of clear water. Thence it is pumped by a Fort Pitt plunger pump of 12 inch steam and 6 inch water cylinders and 18 inch stroke, built by Wilson, Snyder & Co., to two wooden tanks 3,000 feet distant from and 200 feet above the central part of the town. Distribution is by 4 miles of Kalameined wrought-iron pipe with 100 taps and one fire hydrant. The town does not pay for fire service. Service pipes are of iron. The daily consumption is 12,000 gallons. The population in 1880 was 1,614. The works have cost $10-000. There is no debt. The yearly expenses of maintenance are $800 and the receipts $1,000.

H. L. Weaver is President of the company and S. Percy McRea, Secretary.

WATER.

THE Committee has reported to the Maine Legislature favorably in giving a charter to the Norway Water Company.

CUTHBERT, GA., January 21.—The work on the artesian well is progressing most satisfactorily in every respect. Already a depth has been reached of 230 feet.

MALDEN, MASS., through its water commissioners, recommends the laying of a new main to Spot Pond, and the further testing of drive-wells in Ward 6.

BUFFALO, N. Y. is threatened with a water famine by the choking of the tunnel inlets with ice in the Niagara River. Men are tunnelling and blasting the ice with dynamite.

THE insurance companies doing business in the City of Athens, Ga., have reduced their rates this year on account of the water-works, so as to many times repay the expense of the same.

HAMILTON is now said to be supplied with the purest water in the State of Ohio, and that by the best water-works, built for less money than any works of their size and capacity.

THE PITTSFIELD N. H. AQUEDUCT CO., made a trial of the fire hydrants a short time ago, throwing four streams from one hydrant, three against a strong wind over the highest block and are very well satisfied with the result.

THE Toronto Water Committee has accepted the bid of the St. Lawrence Foundry Co., for $67 per ton for 36-in. pipe and $2.50 per hundred pounds per special castings.

THE Empire State Sanitary and Fertilizer Co., of New York, was incorporated on Jan. 21st. The capital stock is $2,000,000; the object is to use or manufacture, machinery for the treatment of sewage, etc. G. W. Daniels, of Boston, H. E. Merrill, of Brooklyn, and Jas. A. Tyng, of New York, are the incorporators and trustees.

THE City Council of Chattanooga has advised the Board of Health to prepare a report of the number of persons taking water from the water-works; also the number taking water from the various wells, springs and cisterns, with the location of the aforesaid wells, cisterns and springs.

A NEW steam cylinder for the Jersey City Water-works has been recently shipped by the West Point (N. Y.) Foundry. The casting for this cylinder, which is 85 inches in diameter by 13 feet stroke, weighed about 21,000 pounds, and was perfect in every respect. The entire shipment weighed nearly 42,000 pounds.

MUNCIE, IND., on Jan. 20th granted a franchise for the building of water-works to Abbott L. Johnson, T. F. Rose, S. A. Wilson and S. M. Highlands. These contractors will at once proceed to form a stock company with a capital of $100,000, and complete the works by Jan. 1, 1887. The city is to be supplied with 85 hydrants, and water for all public buildings for $5,000 per annum.

SENATOR YOUNG of Cumberland, Me., introduced a bill to amend the banking law, so as to allow savings banks to make investments in the first mortgage bonds of any water company in this State actually engaged in supplying, to every city or town having not less than 4,500 inhabitants, water for domestic use and for the extinguishment of fires.

NASHVILLE, TENN., among its appropriations to be acted upon next week by the City Councils, has the following bills: $43,000 for a crib and suction pipe to the pumping station: $80,025 for boiler and connections and foundations, pump well, building and stack for boiler house; and $164,730 for the purchase of 13,600 feet 36 in. water pipe, 90,720 lbs. of lead, and the freight, hauling and laying of said pipe.

ALBANY, Jan. 23.—The requisition of the Water Commissioners on the Common Council to issue $400,000 in bonds for the duplication of the pumping engine and machinery, which supplies the city with water from the Hudson has stirred up the water supply question again. The argument against the impurity and unwholesomeness of the river water is advanced, and there is call for another investigation for other sources of water supply.

CHIEF ENGINEER ARTINGSTALL, of Chicago Ill., wants three pumping engines on the south side with a combined capacity of 30,000,000 gallons daily. These engines should be able to furnish water with a head of 300 feet, so as to accommodate those who require pressure for mechanical purposes, at a decreased expenditure of water. The capacity of the present tunnels is given at 150 millions of gallons, and the present consumption will sometimes reach 100 million gallons, though the average is much below that figure.

DUMONT'S sewerage scheme for Paris contemplates the construction of a drain about 100 miles long from the city to a covered reservoir below Herblay on the right bank of the Seine, and between Dieppe and Treport, and the establishment of pumping stations at Eragny and Serifontaine. It is estimated that for nine months of the year almost the whole of the sewage will be taken up by irrigation. The entire cost of construction is expected to be not more than $12,000,000 and it is anticipated that the maintenance of the pumping stations will be fully secured by the sales of the sewage for irrigation purposes. Only during one-quarter of the year will much of the waste of the French metropolis reach the sea at all.

GAS V. S. ELECTRICITY IN LEWISTON ME.—Alderman Callahan presented bills and read figures of the cost of gas and electric light compared. Lewiston pays $2.45 per thousand for gas. It pays actually $3, but once a year a rebate of 55c. per thousand is allowed—the gas company having the use of the money for the year. In Boston, gas comes at $1.50 to $1.37. Chicago, $1, and other cities nearly everywhere less than here. The relative cost of gas and gasoline shows in the city lights a saving of $212.50 per year, while the gasoline lamps burn until morning in many cases. The city has also to pay for digging out the gas pipes when frozen, and has to pay for them when so frozen, as if they were lighted.

The aldermen presented a series of figures showing the cost for lighting City Hall thirty-six nights from October, 1883 to February, 1884, when there were no electric lights in the hall, against thirty-eight nights during the present fall, when there have been electric lights. The balance in favor of the thirty-eight nights with four electric lights and 13 gas jets against 36 nights with no electric lights and the number of gas jets required to light the hall is $150.80 which the aldermen claimed showed the saving from the electric lights.

NEWS OF THE WEEK.

Railroads, Bridges and Canals.

Cambridge Bridge.—The Citizens of Cambridge, Mass., and the Boston press, are again urging the erection of the proposed bridge to connect the two cities.

The Selma & Cahaba Valley R. R. of Alabama, was incorporated last week. It is to run from Selma to the Cahaba Coal fields.

"Pe-Mickey."—Master of Transportation Jones, of the Lake Erie road, is endeavoring to suppress the title "Pe-Mickey," applied to the Pittsburg, McKeesport, and Youghiogheny railroad.

Proposed Canal.—A bill will be reported favorably in Congress appropriating $10 000 to make a survey of the proposed canal connecting Lake Michigan with the Detroit River.

Anniston and Attila R. R.—President J. C. Fawcett of the above road was in Gadsden, Ala., on the 20th and stated that work will commence on both ends of the road as the weather moderates. Anniston is in Alabama.

The Canton Iron Bridge Company, of Canton, Ohio, has received a contract to erect six iron bridges over different streams in Gilmer County, W. Va. Their bid was a fraction over $13,000 for the entire work, and the same to be completed before July 1, 1885.

Railroads at Yale College.—Among the courses of lectures to be delivered at Yale College during the coming year is a series to be given by Arthur T. Hadley on "Railroads; Their History, Their Business Methods and the Social Problems Connected with Them."

Minneapolis Bridges.—If the legislature of Minnesota authorizes the borrowing of $425,000 for bridges, the amount will probably be distributed as follows: For a bridge on Washington avenue south, $125,000; for a north Minneapolis bridge, $75,000; for one in the central part of the city, $225,000.

The South Pennsylvania.—The rumor that Wm. H. Vanderbilt had concluded to sell out his heavy interest in the South Pennsylvania R. R., is denied by Dr. Hostetter, of Pittsburg, also a heavy stockholder The Doctor says that the work is in no wise suspended, the tunnels are being pushed with the intention of finishing them first. He expects the road to be in full operation by June, 1886.

Alabama R. R's.—On Jan. 21, bills were presented to the Alabama Legislature to charter the Mobile and West Alabama R. R., and the Gulf and Mineral Railway Co. The first is to run from the Gulf and Mobile R. R., north to Tuscaloosa; capital stock $6,000,000. The other is from Deep Water on the Gulf, via Maury, to the Tennessee River, through the coal and iron regions of Alabama.

Street Cars by Electricity.—It is said that the electric motor for street cars will be an established institution in Cleveland, as arrangements are now being made by the East Cleveland Street Railroad Company to use the Knight-Bentley system on Cedar, Euclid and Garden Streets, east of the stables of the various lines. It is expected that the electric lines will be in operation within three months.

Fast Time.—The Cincinnati Southern Northbound train which left Chattanooga, Tenn., Monday morning the 19th made a very fast run to Cincinnati. The train was four hours late leaving. Engineer Chapin ran to Somerset, a distance of 177 miles in five hours, including eleven stops. The run from Somerset was made in four hours and twenty-five minutes, a distance of 158 miles, the entire 335 miles being run in nine hours and twenty-five minutes.

An Electric Alpine Road.—Mr. Charles Barde, a Swiss engineer, has projected an electrical railway between the Hotel des Alpes at Territet and the Hotel Montfleari 180 meters higher up. The line will have a length of from 800 to 1,000 meters and the gradients will vary from 10 to 30 per cent. The journey from one end to the other would occupy seven or eight minutes, and each carriage would accommodate eight travelers.

The cable cars, of the Philadelphia Traction Company began running regularly in that city on Monday last for the purpose of carrying passengers. The delay in starting the line gave rise to the rumor that the material which had been used to make the cables was inferior, and the action of the extreme cold weather had rendered them useless. This is incorrect.

Proposed Detroit Canal.—The House Committee on Railways and Canals decided to report favorably Representative Lacy's bill providing for the appropriation of $10,000 for the purpose of making a survey of a water route to connect the waters of Lake Michigan with the Detroit River. The distance between the lake and the river is 178 miles. The estimated cost of the proposed route is $4,754,860.

Canadian Railroads.—Preliminary notices for applications for charters for the following roads were offered in the Canadian Parliament, Jan. 23rd.

Lobique Valley railway from Perth station on the New Brunswick railway to Plaster Rock.

Amherst and Prince Edward Island railway, starting from Amherst, Nova Scotia, and going to Cape Tormentine, New Brunswick.

For a Railway from Sandwich or Windsor to Kingsville or Leamington, with branches to Amherstburg, to Combar in Essex, and Charing Cross or Rondeau in Kent.

For a Railway from Bow river, near Calgary, or between Calgary and Crowsfoot creek, thence to Edmonton and Athabasca.

The Erie Railroad began last Monday to take up the third rail on the Honesdale branch. This is a preliminary to taking it up the entire length of the road, thus using only the standard gauge on the Delaware Division. The work will be finished by June 1st. The construction of 40 locomotives is necessary, and the machine shops at Susquehanna were put on full time recently. Three hundred additional men will be put on in a short time. There is a probability that many men will be employed all along the road, which will give a boom to the entire country through which the road passes, now almost prostrated by the dull business of the road.

A Southern Delaware Outlet.—WASHINGTON, Jan. 25.—The Secretary of War has submitted the report of the Chief of Engineers of the results of a survey made under the direction of W. F. Smith, United States agent, of Lewes Creek and Rehoboth Bay, Delaware, Assateague and Chincoteague Bays, Maryland, with a view to forming a continuous inland navigation from Chincoteague Bay, in Virginia, to the Delaware Bay, at or near Lewes.

In his report of the survey, Mr. Smith says: "The facts developed by the survey are as follows: The distance to be benefited is 72.91 miles; the distance to be improved is 15.91 miles, of which there are from Delaware Bay to Rehoboth Bay, 11.4 miles; White's Creek to Little Assawoman Bay, 4.51 miles, giving clear navigation on the main line of 72.91 miles, and taking into account the subsidiary water courses which are now navigable, would open to commerce by water over 200 miles." The estimated cost of the improvement is $350,000.

"Chain of Rocks" Bridge.—The bill authorizing the construction of a bridge across the Mississippi, at St. Louis, passed the U. S. Senate on Jan. 21. The bill provides that if the bridge is located below a point 4½ miles above Grand Avenue, St. Louis, it shall be made with unbroken or continuous spans; it shall have at least two channel spans not less that 300 feet in the clear, or one span of 500 feet span. The head room under bridge is left blank in the bill. If the bridge is located above the point named, it may be either a high or a low bridge; if a high bridge, it shall have two channel spans of 400 feet each or one of 500 feet; with a clear headroom under the spans of 50 feet above extreme high water. If it is a low bridge, it shall have at least one draw-span of not less than 400 feet, with a crib 500 feet long extending up and down the River. The bridge is to be open to all railroad companies, with equal rights and privileges, on the payment of a reasonable compensation.

New Railroads.—A company has been formed in Quebec to build a railroad from Quebec to Labrador.

ARTICLES of incorporation of the Ishpeming, L'Anse & Ontonagon Railroad Company, with a capital stock of $1,000,000, have just been filed with the Secretary of State at Lansing, Mich. The stockholders are James McMillan, Hugh McMillan, George Hendrie, William B. Morgan, John S. Newberry, Francis Palms, and F. E. Driggs, all of Detroit. The company intends to build a railroad from Ishpeming, Mich., to Ontonagon, on Lake Superior, a distance of eighty miles.

BROCKVILLE, ONT., has voted $16,000 to aid the Westport and Sault Ste. Marie Railway. Other towns on the proposed route are voting aid.

IT is understood that the Cincinnati, Wabash and Michigan Railroad will be extended to Indianapolis during the spring. The present Southern terminus is Anderson, from which point it is proposed to build twenty-two miles of track to a junction with the Indiana, Bloomington and Western Road, six miles east of Indianapolis, and crossing the track of the latter company, secure an entrance to the Union Depot and the use of the terminal facilities in the Capital City. It is learned that work will be begun on the extension as soon as the frost is out of ground.

THE surveys of the proposed railway from Tapachula to San Benito, Chiapas, Mexico, are now completed. The length will be eighteen kilometers.

FOR more than a year the Nashville and Spartanburg Railroad has been stopped at Hendersonville, 22 miles from Asheville, N. C. It is now announced by authority that work will be commenced again as soon as the the weather opens. A contract has been made with the penitentiary officers for a force of 200 convicts. It is intended to complete the road to Asheville by the 1st of June.

Pipe Laying.—Last week 38 bids were opened for pipe laying, etc., in Willimantic, Conn. The following data is furnished us by J. T. Fanning, C. E., the bids for pipe laying being by the lineal foot:

Quantity.	Size, etc.	Average bid.	Lowest.	Highest.
10 887 lin. ft.	14 inch pipe.	41 7/8 cts.	30 cts.	95 cts.
4 892 "	12 inch "	41 5/8 "	30 "	95 "
100 "	10 inch "	37 "	28 "	90 "
4 165 "	8 inch "	31 7/8 "	25 "	90 "
34 600 "	6 inch "	30 7/8 "	16 "	85 "
400 "	4 inch "	30 7/8 "	16 "	85 "
1	14 inch Valve Setting.	$4 05	$1 00	$15 00
5	12 inch " "	3 35	1 00	10 00
1	10 inch " "	3 23	1 00	10 00
2	8 inch " "	3 00	75	10 00
25	6 inch " "	3 00	50	10 00
1	4 inch " "	2 54	40	10 00
2	Check Valves "	4 05	40	15 00
120	Fire Hydrants "	4 42	40	11 00
2	Street Stand Pipes setting	5 86	1 00	20 00
1500 cu. yd.	Rock Trench per cu. yd.	3 80	1 50	5 00

New Railroad Scheme for Nashville.—It is an open secret in railroad circles that Mr. C. P. Huntington was given a month's option on the purchase of the Owensboro & Nashville Railroad, and in well informed quarters the hope is strongly entertained that he will buy the road. This, it is understood, will involve its completion from Adairsville, the present terminus, to Nashville, in almost an air line, following the course between Springfield and Gross Plains, directly to Nashville.

The Proposed Bridge at Memphis.—Congressman Casey Young's bill for a bridge across the Mississippi at Memphis, which has passed the House, provides that two of the spans shall be not less than 550 feet in the clear. No span shall be less than 300 feet. The lowest part of the superstructure must be at least 65 feet above extreme high-water mark. All railroads desiring to use the bridge are entitled, on payment of reasonable compensation, to equal rights and privileges. The bridge is to be located and built under such regulations as the Secretary of War may prescribe for the security of navigation. Such aids to craft as booms, dikes and piers, as may be necessary, are to be provided at the cost of the parties building. The bill names as the corporations, the Tennessee and Arkansas Bridge Company and the Tennessee Construction and Contracting Company. Up to this time no bridge has been authorized on the Mississippi below Cairo. The Committee on Commerce, however, made a favorable report on the proposed structure and the bill went through without opposition. It will be pressed now for prompt action in the Senate.

A State's Right Bridge Case.—Decision was rendered in a State's right bridge case, John T. Cardwell, appellant, against the American River Bridge Company; appeal from the United States Circuit Court for the District of California. This is a suit brought by appellant, who is the owner of valuable lands and stone quarries on American River in California, to enjoin the appellee, a bridge company, from maintaining a bridge without a draw across that river, thus obstructing its navigation. As the bridge was duly authorized by law of the State the bridge company filed a demurrer to the bill of complaint, and it was sustained by the Circuit Court. This Court holds: 1. As it has held in many previous cases, that the power of States to authorize the construction of bridges over navigable streams is subordinate to that of Congress, but until Congress acts such power is supreme. 2. That the section of the act admitting California to the Union which provides that she shall be admitted "on an equal footing with the original States in all respects whatever," supersedes the section which provides that "all navigable waters within said States shall be common highways and forever free," etc. California, therefore, is not deprived the latter provision of any of the powers which the original States possessed over such waters within their limits. Decree of Circuit Court is affirmed.

Wisconsin Railroads.—The total miles of railroad in the State of Wisconsin the 31st day of December, 1884, was 4,204.54; an increase of 370.8 miles since Dec. 31, 1882. The earnings for the year ending June 30, 1883, were $19,706,858, an average of $5,344 per mile of operated road: the operating expenses and taxes were $12,513,745, an average of $3,393; and the net earnings for the year were $7,191,112, or an average of $1,550 per mile. The earnings for the year ending June 30, 1884, were $20,411,573; expenses and taxes, $12,689,996; earnings per mile, $5,131; expenses per mile, $3,190; net earnings, $7,721,577; and net earnings per mile, $1,941. The number of passengers carried in the year 1883 was 3,807,675, being an equivalent of 169,991,697 passengers carried one mile. In the year 1884 there were 4,473,480 passengers carried, or an equivalent of 179,919,011 passengers carried one mile; being an average of 46.69 miles traveled by each passenger, and at an average cost of 2.69 cents per mile. The number of tons of freight carried in the State 1883 was 4,462,367, equal to 758,352,663, tons carried one mile; in the year 1884 the number of tons of freight carried was 4,670,201, an equal of 949,267,585, tons carried one mile, and at an average cost of 1.44 cents per ton per mile.

The number of persons employed by the railroad companies for the year ending June 30, 1884, was 15,421, and the total sum paid these employes was $8,834,358, being an average of $572 each per annum.

Contracting.

The King Iron Bridge Company, of Cleveland, Ohio, has delivered the iron for the five new bridges ordered by the city of Knoxville, Tenn.

Buildings Erected in Utica.—There were 182 new buildings erected in Utica last year, at a cost of $880,000. Of these 140 were dwellings, 14 were stores, and about 20 were factory buildings.

A Bill was introduced into the Wisconsin Legislature Jan. 20, authorizing the city of Neenah in Winnebago county to build several new bridges and to raise money therefor, by bonds and tax.

Earth Filling.—Bids will be received up to February 10th at the office of the Health Department, 301 Mott Street, New York, for furnishing 5,000 cubic yards of earth filling on North Brother Island in the East River.

A New Club House.—ALBANY, Jan. 23.—Assemblyman Van Allen introduced a bill this morning which authorizes "The Down Town Association of New York," a society composed of dealers in leather, to build a new club house. The building is to cost, $300,000.

Keithsburg Bridge.—Gen. W. C. Hurd, President of the Keithsburg Bridge Co., is said to have executed a contract on Jan. 28th with the Phœnix Bridge Co. for its construction. The bridge is to cross the Mississippi at Keithsburg, for the Iowa Central R. R.; it is to be finished next September.

Indianapolis Bridge Co.—The contract for building a bridge over Pogue's run on East Street, Indianapolis, Ind., was awarded to S. H. Godfray, of the Indianapolis Bridge Company, for $4,251.61 on Jan. 20th. The Big Four road and the C. H. & L. railroad join the city in building a part of the bridge.

Building Contracts Let.—Contracts in connection with the new building of the Young Men's Association, Buffalo have been let as follows: Mason work, Charles Berrick, $39,977; carpentry and glazing, Jacob Reimann, $27,870; iron work, H. C. Harrower, $35,998; cut stone W. D. Collingwood, $19,773; steam heating, Iribacker & Davis, $12,426; plumbing, Iribacker & Davis $4,182.

Grading St. Paul, Minn.—The following bids were received for grading Mississippi Street, St. Paul, Minn., on Jan. 19th at an estimated cost of $11,500: J. D. Nevin, $12,994; Jas. McDonald, $22,625; P. F. O'Halloran, $11,750; Matt Breen, $13,835; A. Guerard, $14,525; P. H. Thornton, $13,994; E. J. Bell, $14,854.75. Awarded to P. F. O'Halloran. The above bids are for grading the approaches to the proposed Robert St. Bridge at St. Paul. The contract was awarded by the Board to P. F. O'Halloran, and confirmed by the City Council.

N. Y. State Survey.—According to the recent (Jan. 28th) report to the State Senate, the triangulation of the State of New York is completed in half the countries at a cost of $108,000. An anual appropriation of $22,000 for five years would complete the triangulation work. The Topographical survey costs from $10 to $20 per square mile. The U. S. Survey covers 985 miles; the Adirondack Survey, 12,055 miles, and the State Survey, 33,080 miles. The total cost for the topographical survey would be about $505,260.

Following Bills were introduced into the Minnesota Legislature, Jan. 22, appropriating amounts as stated:

$1,000 to bridge the Lac Qui Parle river, in Lac Qui Parle county. $1,600 to build bridges in Lyons county. $1,200 to reconstruct a wagon bridge over Roberts creek in Nicollet county. $1,000 to bridge the Crow river, in Carver county. $1,000 to build a bridge in Aitkin county. $1,200 to bridge Buffalo creek, in McLeod county. $1,200 to build a bridge across the Minnesota river in Lac Qui Parle county. $5,000 to build a bridge across the Mississippi river at Sauk Rapids. $200 to build a bridge in Pepestone county. $600 to bridge the Chippewa river in Douglas county. $32,000 to bridge across the Le Sueuer river in Blue Earth county. $5,000 to improve the wagon road from Duluth to Pigeon river.

BIDS RECEIVED JAN. 19, 1884, FOR THE CONSTRUCTION OF ABUTMENTS AND PIERS OF THE PROPOSED IRON BRIDGE OVER THE MISSISSIPPI AT ST. PAUL, MINN., AT ROBERT STREET.

Classification.	Engineers Estimate of quantity.		Bids received.				Item Prices.	
	No. 1	No. 2	F	A	B	C	D	E
Excavation	500 c. y.	2,000 c. yd.	$1.00 c. y.	.50	1.50	2.00	1.75	.40
Piling in ground.	2,000	20,000	Oak. Pine. 33c. 36c.	.49 — .46	.41 — .36	.41 — .36	.41 — .36	.35 — .30
" cut off	10,000	10,000	15c. 12c.	.14 — .11	.14 — .10	.14 — .10	.14 — .10	.25 — .20
Oak Timber—B. M.	70,000	70,000	$50. $30	45.66— 40.66	45.00— 35.00	45.00—35.00	45.00 — 35.00	40.00—30.00
" Pine	70,000	70,000	30.00	40.66	35.00	35.00	35.00	30.00
Concrete, cubic yards.	10 c. y.	10 c. y.	$6.00 c. y.	10.00	7.00	5.25	36.00	6.00
Masonry, class "A" St. Paul stone	1,200 "	1,200 "	1.50 "	4.00	2.00	4.75	3.00	3.00
Dry Masonry, class "B" St. Paul stone.	170 "	170 "	6.00 "	9.00	5.00	8.25	5.00	5.00
Uncoursed Rubble, "C" St Paul stone.	10 "	200 "	8.00 "	5.00	7.00	3.25	7.00	7.00
Range work, class "D" St. Paul stone.	10 "	777 "	10.00 "	12.00	9.00	8.25	11.00	8.00
Filling, class "E" St. Paul stone.	765 "	765 "	10.00 "	12.50	9.00	6.25	13.00	8.00
Footing courses, class "F" Red Wing.	1,014 "	1,014 "	15.00 "	16.75	12.00	14.25	16.00	14.00
Piers, class "G" Red Wing.	2,660 "	3,020 "	13.00 "	17.00	15.00	14.75	17.00	14.50
Granite, class " "H" Facing.	1,180 "	1,180 "	20.00 "	28.00	31.00	24.75	32.00	30.00
Granite, class "I" Ice Breakers.	246 "	246 "	35.00 "	30.00 "	48.50	25.75	50.00	45.00
Caisson, coffer dam, Pumping, etc., six Piers.			9,200	25,350	16,860	16,860	16,860	10,000
Total bids { Oak. Pine.			$140,880.00 125,510.00	188,861.00 171,837 00	167,837.00 151.954.40	157,790.50 142,535.29	185,786.00 167,274.00	158,922.00 145,276.00

Names of above bidders:
"A"—A. Bruce & Son, Marseilles, Ill.
"B"—Chas. & H. Lauer, St. Paul, Minn.
"C"—Martin Ring, Mankato, Minn.
"D"—John Nevill & Son, St. Paul, Minn.
"E"—McArthur Brothers, Chicago, Ill.
"F"—M. M. A. & E. J. O'Brien, St. Paul, Minn.

The above bids were received on January 19, by the Board of Public Works of St. Paul, Minn., for the construction of the abutments and piers of the proposed iron bridge over the Mississippi River at that point. The bridge passes over the St. Paul, Minneapolis & Manitoba R. R. The engineers' approximate estimate of cost was $121,000. Estimate No. 1 is the amount of work to be done in case a temporary substructure is used. Estimate No. 2 is the amount of material, etc., required for a permanent bridge.

This is the third bridge being constructed across the Mississippi River at this point within 1200 feet of each other. The Wabashaw Street bridge is being replaced by a permanent iron superstructure by the Missouri Valley Bridge Co. The contract has not yet been awarded by the Board. The bids are considered very low. This data has been furnished ENGINEERING NEWS by E. J. Bell, of St. Paul.

(BOSTON) CANVASS OF BIDS FOR CAST-IRON PIPES FOR NEW HIGH SERVICE WORKS. RECEIVED JAN. 20, 1885.

Items.	A. H. McNeal Burlington, N. J.	Warren Foundry & Machine Co., Phillipsburg, Pa.	R. D. Wood & Co. Philadelphia, Pa.	Gloucester Iron Works Phila.	Allston Gerry & Co., New York.	Mellert Foundry & Machine Co. Reading, Pa.
			Price per ton	of 2240 lbs.		
470 tons 30 inch pipe class A	26 45	27 10	27 10	27 77	28 50	29 50
1450 " 30 " " " B	26 45	27 10	27 10	27 77	28 50	28 50
900 " 24 " " " B	26 45	27 30	27 10	27 77	29 50	30 00
50 " 16 " " " B	26 45	27 70	27 10	27 77	30 00	30 00
100 " special castings	53 20	55 00	58 24	56 00	62 60	67 20
Total amount of contract	$81231 50	$83487	$83601	$85299 90	$89030	$90410

Contract awarded to A. H. McNeal.

Minneapolis Street Paving.—The Street Committee of the Minneapolis, Miss. Councils, opened bids, on Jan. 20, for Street paving per square yard as given below. The bids designate the price of paving per square yard, and also the price for excavating per cubic yard. In awarding the work, however, the basis taken is what is termed the "aggregate" price. To obtain this, the price for excavating one-sixth of a cubic yard is added to the price for paving a square yard. Thus, if a contractor bids $2.50 for paving a square yard and 30 cents for excavating a cubic yard, his aggregate price is $2.55. This is on the assumption that one-sixth of a cubic yard of excavating is necessary for a square yard of paving. The committee did not act on the bids at once, but will defer making any recommendation until the return of City Engineer Rinker. Thomas Canney, however, will doubtless receive the cedar paving, as his bids on the respective streets were lower than on any other contractor's. James T. Tobin, on the cedar paving, bid $1.49 for paving and 80 cents for excavating. If his offer for excavating had been anywhere near the other bids he would probably have captured the job. For the granite paving William Forristal was the lowest man on the Washington Avenue, First Street, and Eighth Avenue work, and Coates, Freeman, and Tobin made the closest figures on the Sixth Avenue job. Below are bids in detail:

Bidders.	GRANITE PAVING.				CEDAR PAVING.					
	Washington avenue.	First street.	Sixth avenue south.	Eighth avenue south.	Second avenue south.	Third street.	Fourth avenue south.	Seventh street	Nicollet avenue.	Washington avenue.
H. B. Willis	2 63 5-6	2 63 5- 6	2 63 5- 6	2 63 5- 6	1 63 5- 6	1 63 5- 6 1 61	1 63 5- 6	1 63 5- 6	1 63 5- 6	1 63 5- 6
Jaicks & Thatcher	2 71½	2 71½	2 71½	2 71½	1 53 5- 6	1 40½	1 58	1 56 5- 6	1 59	1 59
Richard Forristal	2 53½	2 53½	2 53½	2 53½	1 40½	1 61 1- 6	1 40½	1 40½	1 40½	1 40½
William Forristal	2 45½	2 45 5- 6	2 52 1- 6	2 43½	1 52 1- 6	1 43½	1 60 1- 6	1 58 1- 6	1 59 1- 6	1 60 1- 6
J. B. Smith & Co.	.....	.....	.....	.....	1 40½	1 61 11-12	1 42½	1 41½	1 43½	1 43½
J. J. Palmer	2 61½	2 59½	2 61½	2 61½	1 58 11-12	.....	1 62 11-12	1 58 11-12	1 62 11-12	1 61 11-12
Winston Bros.	2 55½	.....	.....	2 55½	.....	1 60½	.....	.....	1 60½	.....
Thomas Reilly	2 50	2 50	2 50	2 50	1 63½	1 65½	1 65½	1 65½	1 65½	1 65½
Thomas Canney	.....	2 57 7-12	.....	2 57 7-12	1 24 1- 5	1 39¼	1 39¼	1 29 1- 5	1 38	1 39¼
Watson, Perkins & Forest	.....	.....	.....	.....	1 45 5- 6	1 45 5- 6	1 45 5- 6	1 45 5- 6	1 45 5- 6	1 45 5- 6
S. P. Fulson, Jr.	.....	.....	.....	.....	1 59½	1 61½	1 61½	1 58½	1 60 5- 6	1 59 5- 6
John Fallon	2 56¼	2 57½	2 56½	2 54 7-12	.....	.....	.....	.....	.....	.....
W. P. Burnett	.....	.....	.....	.....	1 66 1- 6	1 78½	1 77½	1 66 1- 6	1 72	1 78½
Thomas Daly	2 63½	2 65½	2 63½	2 63½	.....	.....	.....	.....	.....	.....
Coates, Foreman & Tobin	2 51½	2 51½	2 51½	2 51½	.....	.....	.....	.....	.....	.....
J. H. Nevins & Co.	2 55 5-6	2 55 5- 6	2 55 5- 6	2 55 5- 6	1 47 5- 6	1 47 5- 6	1 47 5- 6	1 47 5- 6	1 47 5- 6	1 47 5- 6
M. W. Nash	2 53 1-6	2 53 1- 6	2 53 1- 6	2 53 1- 6	1 46 5- 6	1 46 5- 6	1 46 5- 6	1 46 5- 6	1 46 5- 6	1 46 5- 0
James T. Tobin	.....	.....	.....	.....	1 62½	1 62½	1 62½	1 62½	1 62½	1 62½

The Boulevard Building Company of Chicago; incorporators, Samuel A. French, N. W. Holsey, and Garrie S. French, was chartered on Jan. 20.

Cincinnati Street Improvement.—The Cincinnati Board of Public Works have resolved, Jan. 22, to improve Oak or Ann St., estimated cost, $11,517.77.

Miscellaneous.

Indianapolis, Ind., wants authority from the State to build a new City Hall.

Alaska Marble.—A company has been formed in San Francisco to work a marble quarry, of fine quality, in Alaska.

Chattanooga Bridge.—A bill to issue $200,000 in bonds for the erection of a bridge across the Tennessee River, at Chattanooga, has been framed, and the question of its adoption is to be submitted to popular vote.

Richmond, Va., is exercised over its new City Hall problem. At a recent meeting of Councils, a plan was proposed which included a building of Virginia granite, to cost $300,000. This movement has failed, and the whole subject is open again.

Galveston Jetty.—The Prussian engineer, Edward Roemar, denies, in a letter to the *Globe Democrat*, that he has been bought off by the syndicate, and says he is still in the field to build the jetties for half the sum asked for by the Eads jetty people.

The Wisconsin State University has determined to rebuild Science Hall, lately burned, at a cost of $150,000; also to build a chemical labratory and machine shop at an expense of $28,000 more. The heating apparatus for these two buildings is to cost $25,000, and the equipments, $20,000; making a total of $293,000.

L. Beckman, Toledo, Ohio, well known as a maker of first class instruments for Surveyors and Engineers, has bought the stock of Tapes and right to manufacture, of S. Hodgman, of Traverse City, Michigan. These Tapes we believe, have given excellent satisfaction where used, and the demand for them has been growing each year.

The Statue of Liberty.—Wm. Kennish, late chief inspector of the work on Bedloe's Island, for the foundation for Bartholdi's Statue of Liberty, says that the portion of the pedestal erected contains about 14,000 cubic yards of material, and that the work executed is exceedingly good. The entire sum subscribed for this pedestal to date has not exceeded $150,000.

Cincinnati Sewerage.—The Board of Public Works, on Jan. 20, resolved to build Sewers on a number of streets and alleys; estimated total cost, $67,638. Engineer Danenhower reported that on the year 1884, $9,890.36 was expended in constructing and repairing sewers, and that the outstanding indebtedness, on this account, was $5,292.68.

Minneapolis, Min. Contracts.—The contracts awarded Jan. 20, by the Board of Public Works were confirmed, as follows: Wabasha street grading, Bluff to Rice, James Murnane, $5,250; Park avenue grading, Martin to Sherbourne, to same, $15,400; Mississippi street grading, Pennsylvania to Acker, and continuation of abutments for the proposed iron bridge across the Manitoba road on Mississippi street, P. F. O'Halloran, $11,750; Whitall street grading, Westminster to Payne, Charles Faber and R. S. Knapp, $12,300; and Tenth street sewer, Wabasha to St. Peter, Peter Tautholt and R. Hansen, $630.

Galveston Jetty.—A leading business man of Galveston, exposes the inner workings of the scheme, now being vigorously pushed in Washington, to get the $7,750,000 appropriation for the jetties. According to a communication in the Dallas *Herald*, a survey made by the City Engineer shows a depth of 20 feet of water on the south side of the south jetty nearly along its whole length. This is the important discovery that the present syndicate proposes to sell at such a high price. The City of Galveston has appropriated $2,500 for the jetty committee, and a fund of $25,000 has been raised by subscription to the same end.

A Big Check.—A check for $14,949,052, the largest ever drawn, probably in this country, has been framed and hung up in the Treasurer's office of the Pennsylvania railroad company at Philadelphia. It is drawn in favor of Kidder, Peabody & Co. of New York, on the National Bank of Commerce, and dated June 7, 1881, and is in full settlement of the large block of shares which that firm procured for the Pennsylvania railroad company, in order that it might obtain a controlling interest in the Philadelphia, Wilmington & Baltimore railroad company. The check was paid one week ahead of the time due.

Minneapolis proposed Public Work.—The special committee of Directors of Minneapolis, Miss., on Jan. 21, reported as follows on proposed work, for which city bonds are to be issued.

For North Minneapolis sewer tunnel, under contract, $120,000; for sewers proper, $100,000; for bridges, $125,000 was asked, the committee consider it unwise to issue bonds for the bridge as intended; they recommend $225,000 to build a stone bridge, 100 feet wide, at the site of the suspension bridge; $175,000 for water works. The amounts awarded amount in total to $740,000. The present city debt is $2,516,000. The valuation of real and personal property in the city is $74,360,000, and five per cent. of this, or $3,715,000, is the legal limit of bonds that can be issued. The committee also recommend $30,000 for a work-house and $40,000 for street purposes.

Government Improvements.

ASHLAND HARBOR, WIS.—The following estimates for the improvement of Ashland Harbor, Wis., are contained in the report of Lieutenant Colonel Barlow recently transmitted to Congress by the Secretary of War: The design of the proposed breakwater for this harbor, which is believed to be amply strong, consists of two parallel rows of piles, driven 3 feet from center to center, strengthened by wales and cross-ties at the water surface, and finished at the top with two courses of 12 × 12 feet timber on each row, also connected by timber cross-ties.

The width of the breakwater will be at first 12 feet; increasing as more depth is attained to 14 feet, 16 feet, 18 feet and 20 feet, and its total length will be 7,900 feet.

The filling will be of the cheapest material attainable; brush and logs, or slabs and edgings from the sawmills, except a top covering about two feet in thickness, which will be of stone.

A plank walk 2 feet wide will extend the entire length.

The first section of 1,700 linear feet, 12 feet wide, will cost $8.70 per linear foot,	$14,790
The second section of 1,700 per linear feet, 14 ft. wide, will cost $11.93 per linear foot,	16,702
The third section of 1,500 linear feet, 16 feet wide, will cost $14.58 per linear foot,	21,870
The fourth section of 1,500 linear feet, 18 feet wide, will cost $1,682 per linear foot,	25,230
The fifth section of 1,800 linear feet, 20 feet wide, will cost $19,65 per linear foot	35,370
	113,962
Superintendence and contingencies.....	11,038
Total.....	125,000

ESTIMATES OF MATERIALS, AND COST OF BUILDING 7,900 LINEAR FEET OT BREAKWATER AS ABOVE DESIGNED.

Timber, 12 by 12 inches=56,830 linear feet, at 30 cents per foot.....	$17,049.00
Timber, 8 by 12 inches=34,326 linear feet, at 20 cents per foot.....	6,865.20
Plank, 3 by 12 inches=58,300 feet, b. m., at $20 per m.....	1,166.00
Piles, 6,058=160,944 linear feet, at 15 cents per foot.....	24,141.60
Iron, 148,484 pounds, at 5 cents per pound	7,424.20
Filling, brush, slabs, etc., 14,500 cords, at $3 per cord.....	43,500,00
Filling, stone, 1,727 cords, at $8 per cord	13,816.00
	113,962,00

Removal of Shoal.—The quantity of material necessary to be removed from the 11-foot shoal in front of the city wharves, or to make a channel through it of sufficient depth and width to meet present demands of commerce, would not probably exceed 40,000 cubic yards.

The cost of this dredging would be as follows:

40,000 cubic yards, estimated, at 25 cents per cubic yard.....	$10,000
Superintendence and contingencies, 10 per cent.....	1,000
Total.....	11,000
Summary.—Cost of breakwater 7,900 feet in length.....	$113,962
Cost of removing 40,000 cubic yards of sand.....	$10,000
Superintendence and contingencies.....	1 2,038
Total.....	136,000

Ashland is located on the south side of Chequamegon Bay, Lake Superior, about 60 miles east of Duluth, Minn.

Granite Works.—The following is a synopsis of the bids for granite wharf for the custom house at Charleston, S. C.:

John Beattie, Leete's Island, Conn., $75,110.
J. M. McClenahan & Bros., Port Deposit, Md., $41,-907.
Bodwell Granite Co., Rockland, Me., $38,385.
M. A. McGowan, Washington, D. C., $63,714.
Mt. Waldo Granite Works, Frankfort, Me., $34,390.
W. S. White, Rockland, Me., $38,500.
Jos. Ross, Ipswich, Mass., $34,000.
A. Blaisdell, Charlottesville, Va., $28,995.
The bid of Albert Blaisdell has been accepted.

PROGRESS OF HARBOR IMPROVEMENTS.—Lieutenant Carter, United States Engineers, in charge of the Savannah harbor improvement, gives the following summary of the work done under his supervision from the 1st to the 10th of January:

The dams at the Upper Flats and at the Cabbage Tree Crossing have been completed. Twelve mats have been set at a cost of about $3,500.

Work is now in progress above the city, at the Crosstides Dam, which is to be raised to the level of high water. This dam is built for the purpose of throwing the entire water down the main channel, instead of allowing it to go through Back River.

It is probable that some action will be taken at this session of Congress to improve the condition of St. Anthony's Falls, Minn.

The House Committee on Public Buildings and Grounds has made a favorable report upon H. R. 784, providing an increase of the appropriation for the erection of a public building at Marquette, Mich.

The report of the Board of Engineers to the Chief of Engineers U. S. Army, relative to models for movable dams, was transmitted to Congress by the Secretary of War on the 17th. The concluding paragraph of the report is as follows: "The instructions received by the board direct them to examine and report upon the various models submitted to them, and they have endeavored to comply with these instructions by permitting all inventors to speak for themselves, and by giving their own opinions on the various inventions submitted to them. Some of these inventions are meritorious, and by bringing them to the attention of engineers those to whose work they are adapted can make use of them. The majority of the inventions that came before the board are modifications of the venerable and well-known bear-trap, and they are chiefly designed to adapt this gate to wide chutes and to locks, its past service having been limited to narrow chutes. As the United States is now preparing to build wide bear-trap gates on the Kentucky River, on the recommendation of the members of this board, and as the most promising of the many modifications that have come before them will naturally be adopted for that work, it does not seem necessary at this present time to make any special recommendation as to testing any of these devices."

STONE AND BRICK WORK—FORT WAYNE.—The following is a synopsis of the bids for stone and brick work of the basement and superstructure of the court house and post office at Fort Wayne, Ind.:

E. R. Brainard & Co., Chicago, Ill., Stone, Lamont, $33,819; Ohio blue, $24,849; Buff Amherst, $31,084; Bedford, $28,663.

Kenderdine & Paret, Washington, D. C.: Brick, $12,998.

Brumeier & Co., Fort Wayne, Ind.: Brick, $12,936.

Roth & Keller, Fort Wayne, Ind., Stone, Stony Point: $23,733; Bedford, $25,412; Berea, $25,675.

Justin McCarthy, Washington: Brick, $12,700.

C. Boseker, Fort Wayne, Ind.: Brick, $16,800.

W. Moellering, Fort Wayne, Ind.: Brick $9,723.

Albert Neukom, Toledo, Ohio, Stone, Buff Amherst, $28,400; Stony Point, $24,874.

Hollowell Granite Company, Bedford, Ind.: Stone Bedford, $28,787; brick, $11,964.

A. Dall, Jr., Cleveland, Ohio: Stone, Ohio blue, $27,-988; Bedford lime stone and Ohio blue, $28,388; Ohio buff, $30,662; Bedford and Ohio buff, $31,161; brick, $10,800.

M. A. McGowan, Washington: Stone, Berea or Bedford, $29,116; brick, $13,990.

W. D. Collingwood, Buffalo, N. Y.: Stone, Berea or Bedford, $30,300; Amherst, $31,500; Stony Point, $30,000.

W. & J. Grake, Fort Wayne, Ind.: Stone, Stony Point, $24,599; Berea, Amherst or Bedford, $29,831.

LITTLE HARBOR, AT PORTSMOUTH, N. H.—Colonel Charles E. Blunt, in a letter recently transmitted to Congress, makes the following estimates of the amounts required to further improve this harbor:

61,000 cubic yards of dredging *in situ*, the estimated cost of which, including contingencies, is,..... $20,000

A rubble stone breakwater at Jerry's Point, the estimated cost of which, including contingencies, is..... 13,000

Total..... $33,000

Market Report of Engineering Materials.

New York, January 29, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles.....	2.3c.	@	2.6c.
Tee.....	2.8c.	@	3c.
Beams and channels.....	3.0c.	@	3.5c.
Tank.....	2.2c.	@	2.3c.
Shell.....	2¾c.		
Steel plates, Tank.....	3c.	@	3½c.
WROUGHT-IRON PIPE.. PITTSBURGH.			
Butt welded, black.....Discount	47½		
" " galvanized..... "	40		
Lap welded black..... "	47½		
" Galvanized..... "	50		
Boiler tubes.....			
NAILS.			
Steel (large lots at mill).....	$27 @ 30		
Old rails.....	16.50	@	17 50
Old steel rails.....	16	@	17
R. R. spikes.....			2c.
R. R. splice-plates.....	1.65c.	@	1.75c.
R. R. Track Bolts.....	2¼c	@	2¾c.
Barb-wire fencing, galvanized.....			5c.
" " painted.....			4c.
Corrugated iron.....			
Nails.			
Iron.....	2.10, 2¾, 60d.		
Steel.....			

METALS.

COPPER.			
Lake Superior.....	11¼	@	.11½
Other Brands.....	10¾		
LEAD.			
Com. Domestic.....	3.60	@	3.65
Lead Pipe.....	.05¾		
Tin-Lined Lead Pipe.....	.15		
Sheet Lead.....	.06¾		
ZINC.			
Sheet.....	.05	@	05½

BRICK.

(Cargoes afloat)			
Haverstraw 1st.....per M.	$6.00	@	6.25
" 2nd..... "	5.62	@	5.87
Fishkill.....	4.75	@	5.50
Up-River.....			
Jerseys.....	5.25	@	6.00
Long Island.....			
" pale.....			
FRONTS.			
Croton red.....	14.00	@	
" dark.....	14.00	@	
" brown.....	12.00	@	
Philadelphia pressed.....	22.50	@	23.00
Trenton "	22.50	@	23.00
Baltimore "	37.00	@	41.00
Buff "	33.00	@	35.00
Enameled English	65.00	@	130.00
" American	85.00	@	120.00
Fire brick	25.00	@	40.00

CEMENT.

PORTLAND.			
Robins & Co., Extra English 425 lbs...	2.75	@	2.90
K. B. & S. English 400 lbs...	2.85	@	3.00
Burham " " ...	2.70	@	2.85
Rochester Castle " " ...	2.50	@	2.60
J. B. White & Bro. " "	2.50	@	2.60
Other brands, " "	2.40	@	2.50
Keene's fine " "	9.50	@	9.75
" course " "	5.25	@	5.50
Roman.....	2.75	@	3.50
Dyckerhoff, German 400 lbs...	2.60	@	2.65
Star, " "	2.60	@	2.65
Alsen, " "	2.55	@	2.60
Hanover " "	2.40	@	2.50
Other brands, " "	2.35	@	2.40
Saylor's American.....	2.15	@	2.50
Rosendale cements.....	0.90	@	1.00

LIME.

Rockland common per bbl.....	1.00		
" finishing.....	1.20		
Glensfalls, common.....	.85		
" pointing.....	1.05	@	1.10
Kingston, ground.....	0.95		

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90	@	95
" " No. 2 "	0.75	@	0.80
" " light drab "	0.80	@	0.95
Berlin " in rough "	0.75	@	1.00
Berea " "	0.75	@	1.00
Brownstone, Portland, Ct. "	1.00	@	1.30
" Belleville, N. J. "	0.75	@	1.25
Granite, rough.....	0.60	@	1.25
Common building stone per load.	2.00	@	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.....	0.40	@	3.00

SLATE.

Purple roofing per square.	6.00	@	7.00
Green "	6.00	@	7.00
Red "	15.00		
Black Penna. (at New York) "	4.50	@	5.00

LUMBER.

PINE, Common box per M.	18.00	@	20.00
" Good "	55.00	@	60.00
Tally plank, 1¼ in each.	.44	@	.50
Tally boards, dressed "	.28	@	.30
SPRUCE, Boards dressed "	.25	@	.28
Plank, 1¼ in "	.28	@	.30
" 2 in. "	.38	@	.40
" 2 in. dressed "	.43	@	.45
Timber per M.	20.00	@	22.00
HEMLOCK, Boards each.	.18	@	.20
Joist, 2½ × 4 to 4 × 6 in.....	.17	@	.44
OAK per M.	55.00	@	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00	@	40.00
YELLOW PINE, Girders "	26.00	@	35.00
Dressed flooring "	30.00	@	40.00
SHINGLES, Extra shaved pine, 18in. "			
" " sawed " 18 in. "	4.50	@	5.00
LATH, Cargo rate	2.50	@	2.60

PAINT.

Lead, white, American dry per lb.	.04¾	@	.05
" " in oil pure "	.05½	@	.05¾
English, B. B. in oil "	.08½	@	.08¾
Red, American "	.05½	@	.05¾
Litharge "	.05	@	.05½
Venetian red, American "	.01	@	.01¼
Indian red "	.05	@	.10
Vermillion, American lead "	.11	@	.11½
Paris green "	.15	@	.19
Umber, Amer. raw and powdered per lb.	.01¼	@	.01½
Drop black, Amer..... "	.08	@	.12
" " "	.09	@	.11½
Chrome green.....	.05	@	.15
Oxide zinc, American.....	.03¼	@	.04
" " French.....	.06¼	@	.06½

MUNCIE WATER-WORKS.—At a regular Session of the City Council of the City of Muncie, Indiana, held on the 19th inst., a water-works franchise was granted to A. L. Johnson, S. A. Wilson, T. F. Rose, and S. M. Highlands of Muncie, to construct and maintain water-works in the city of Muncie, 7 miles of mains, 85 fire hydrants, etc. City to pay $5,000 per annum. Mr. W. H. Wood is City Civil Engineer.